

SCIENTIFIC AMERICAN

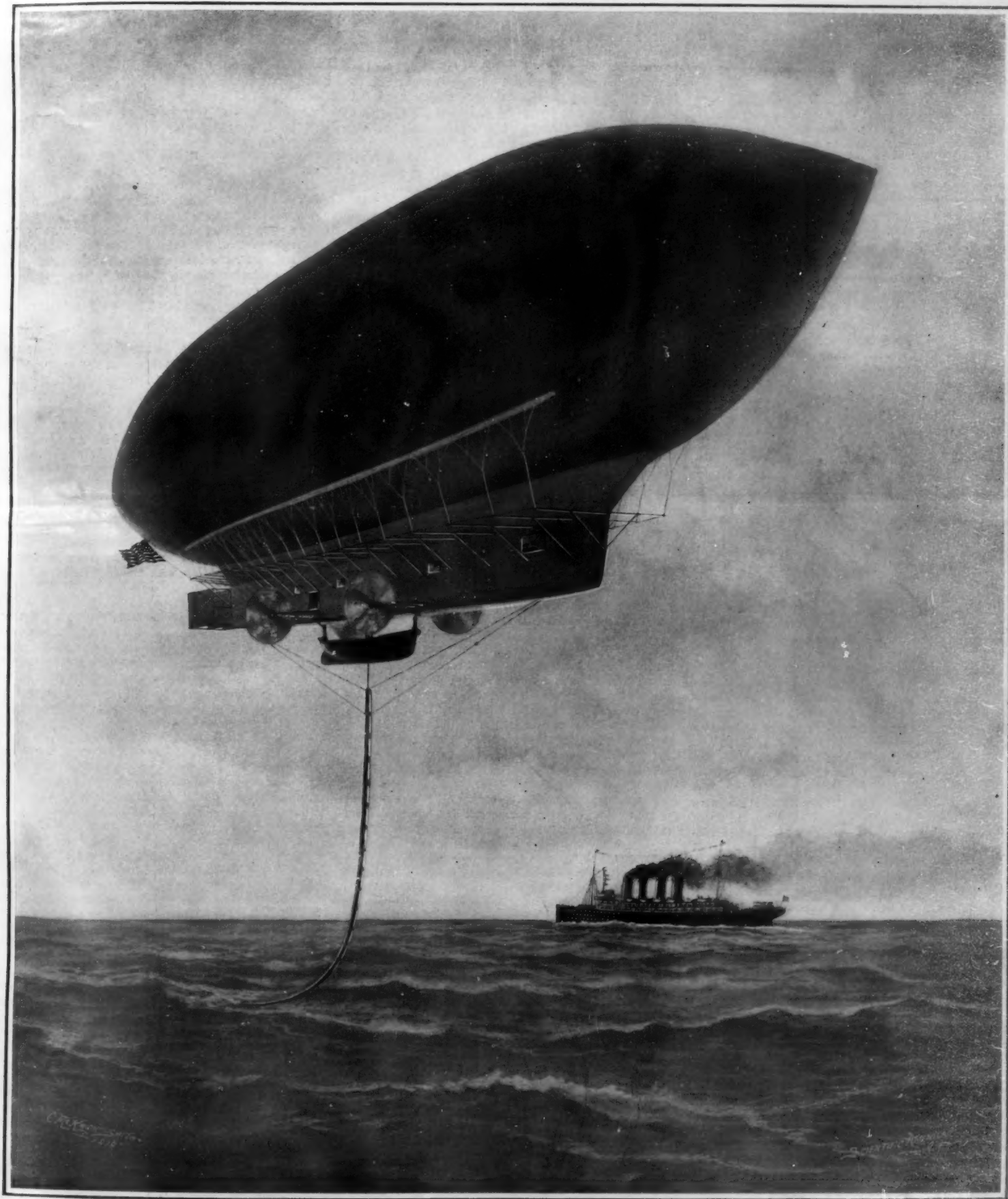
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The Wellman airship; 228 feet long, 52 feet diameter. Lifting capacity, 12 tons. Speed, 20 to 26 miles per hour.

PROPOSED TRANSATLANTIC AIRSHIP EXPEDITION.—[See page 259.]

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NEW YORK, SATURDAY, OCTOBER 1st, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles clear, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE CITY BEAUTIFUL.

It is a timeworn phrase, "The city beautiful"; yet to thoughtful minds these three words contain a sad reminder of opportunities for civic dignity and splendor that are being uniformly neglected in the upbuilding of the mighty cities of our western hemisphere, whose lusty growth is the wonder of all the world. The city wonderful, the city costly, the city luxurious, we have within our borders in plenty; but of the city beautiful, how few.

Therefore we welcome as all lovers of their country should the effort of the Municipal Art Society of this city to bring about co-ordination among those important interests which are concerned in a large way with the laying out of urban and suburban property, and the construction of the more important city buildings.

The failure of New York city, and most of the larger cities of the United States, to present to view those open plazas and spacious boulevards surrounded or flanked by municipal buildings of dignity, and so placed as to present a harmonious architectural combination, is not due to any lack of enterprise or want of capital for construction, but rather, and we might say almost entirely, to want of foresight, and the failure on the part of the municipal authorities, at least in the earlier days, to pay any attention whatsoever to the question of the future architectural and aesthetic appearance of the city.

Such important structures as railroad terminals, steamship and ferry docks and landings, and bridges for spanning our great rivers, to say nothing of imposing municipal buildings, should always be planned with reference, not merely to their utilitarian purposes, but to their architectural fitness as related to the site on which they are built, and the character of the architecture by which they are, or in the future are likely to be, surrounded. The principal cause of the lack of beauty in our cities is to be found in the want of any such co-ordination and supervision in the years gone by. Almost invariably there has been too much individualism, and streets have been laid out and buildings erected according to the passing mood or whim of the city department or the supervising architect in charge. Hence that distressing lack of harmony which completely robs of its charm a street, a public square, or a collection of civic and commercial buildings which, had they been grouped on a well-ordered plan, would have possessed sufficient dignity and beauty to place them in rank with some of the finest and best districts in the older European cities.

The Municipal Art Society has communicated with the leading railroad interests and the commissioners of the tenement house, dock, and other city departments having control of municipal buildings, and has requested their advice in drawing up a revised city plan which shall modify, as far as possible, present defects, and make provision for careful regulation in the future. Although we cannot pull down our cities to rebuild them upon a more wisely ordered plan, we can, at least, make sure that in future extensions or rebuildings the laws of harmony shall be considered. At the present time, hundreds of millions of dollars are being expended in New York alone upon construction, and it is the aim of the Society to so direct this expenditure in regard to the aesthetic and architectural effects produced, as to develop, in the course of time, a practical, comprehensive, and ideal plan for the city of New York. To this end, they will shortly issue a map of the new city as proposed, which will be scattered broadcast and posted in all public places. We

heartily commend this movement to the attention of the citizens, not only of New York itself, but of every one of those great civic centers which the recent Federal census has shown to be having such phenomenal growth.

WAR DEPARTMENT ASKS ADVICE ON ATLANTIC COAST CANAL.

In a report recently made public by Col. Black of the Corps of Engineers, the Federal government asks the commercial and other interests that will be affected by that section of the proposed Atlantic coast canal which will extend between New York and Philadelphia, to submit their views as to whether or not this work is a commercial necessity.

As contemplated by act of Congress, the canal will eventually provide an inland waterway, paralleling the Atlantic coast over the whole distance from Boston to Key West, and extending thence, by way of the Gulf of Mexico, to New Orleans. The work of surveying the route has been assigned to the various engineer officers commanding the districts covered by the route of the canal, and Col. Black, who has charge of the New York district, is now engaged upon the preparation of plans and estimates for that section of the proposed waterway which will reach from New York to Philadelphia.

The preliminary surveys have shown that a practicable route exists between New York Bay and deep water in the Delaware which does not cross any trunk line of railroad. The distance from the Battery, New York city, to the wharves at Philadelphia is about eighty miles, twenty-five miles of which lies through the open waters of New York Bay, thirty miles across the State of New Jersey, and twenty-five miles through a channel dredged in the Delaware River. If a speed of fifteen miles per hour is allowed for traversing New York Bay and the Delaware River section, and a speed of nine miles through the canal section proper, it is found that the time of transit between the two cities through a sea-level canal would be about seven hours, and through a canal with locks, about nine hours.

In determining on the type and cross-section of the canal the governing factors to be considered are the type and carrying capacity of the vessels that will make use of this route, and the total time of transit. Col. Black draws attention to the fact that for a given depth and width of canal, one at sea level will lessen the time of transit about two hours, and will also eliminate the possibility of occasional delays, due either to accidental damage to the gates and machinery of the locks, or to the congestion of shipping at their entrances.

Now it is a principle observed by the government in considering proposed public works of this character, that no scheme shall be undertaken that does not promise a reasonable return for the capital expended. Col. Black believes that the building of the canal will develop the pottery, glass, brick, and other industries in New Jersey very materially, and that it will also tend to lower the freight rates on manufactured products between manufacturing centers along the Delaware River and in the vicinity of New York. Furthermore, it is assumed that if this canal were opened, a considerable passenger and light freight traffic, similar to that carried on between New York and Boston, and New York and the upper Hudson River cities, would soon be established between New York, Philadelphia, and Baltimore.

The total estimate for the construction of the canal is \$38,725,000; and the commercial and other interests that will be affected are requested to take this most important matter under consideration and assist the Board in deciding, from the commercial point of view, whether a lock or sea-level canal is more desirable; what should be its width and depth; and what is the reasonable amount of traffic which may be looked for within stated periods of time.

THAT MOTOR-DRIVEN BATTLESHIP.

THE cabled dispatch from abroad, stating that Great Britain is about to build a motor-driven dreadnought, is strongly suggestive of the classic story of the "Three Black Crows." Without claiming to be deeply in the confidence of the British Admiralty, we venture to affirm that the facts are that the authorities, encouraged by the results obtained with producer-gas engines in the old gunboat "Rattler," have decided to try either this system or the oil engine in a destroyer, gunboat, or small cruiser. That would be the next logical step, and it would be in line with the conservative policy followed by the Admiralty in applying the turbine to warship propulsion. First the new motor was tried out on the destroyers and one of the class of fast cruisers, and then, upon the data so acquired and other data afforded by turbine operation in the merchant marine, the naval engineers felt justified, since the turbine was no longer an experiment, in applying it to the 18,000-ton "Dreadnought." The modern battleships call for motive powers of between 30,000 and 40,000 horse-power, and

the internal-combustion marine engine, in its present stage of development, is quite unfitted for use on a warship in powers of this magnitude.

It is all very well to point out the advantages of abolishing smokestacks and leaving the entire upper deck of a warship free of obstructions to the all-around fire of the guns; but the simple fact is that there are problems below deck involved in the substitution of gas for steam which, in all probability, will forbid such a change, at least in high-powered battleships and cruisers, for many a year to come. If the prospects of the use of gas or oil engines for this work were favorable, we would expect that the first authorities to say so would be those specialists and manufacturers who are devoted to the development of this type of engine. Therefore, the following destructive criticism, which was made only a year ago by two leading gas and oil engine men in England, carries peculiar weight, and may be taken as the last word on this subject, at least for some years to come.

In an able article by a member of the Institute of Naval Architects of Great Britain, published in the Shipping World, it is pointed out that the Admiralty surely ought to know what they are doing in this matter, seeing that they have had a wide experience with internal-combustion engines in units up to 600 horse-power, installed in the fleet of submarines. One formidable difficulty is the provision of a suitable clutch for variations in speed and for reversing. While it is known that an oil engine of the Diesel type is being built on the Continent to develop 10,000 horse-power, no clutch has yet been devised, apparently, that can properly take care of such large power. While the results obtained with the small producer-gas engine on the "Rattler" have been satisfactory, to install this type on a dreadnought would be an experiment of the most extravagant kind. It is not the custom in modern engineering enterprises involving an expenditure, as in the case of a dreadnought, of ten million dollars, to hang the success of this investment upon the hazard of experiment; and such, in the present state of the art, a motor-driven battleship would necessarily be.

But referring again to the testimony of the men who are most interested in the promotion of oil and gas engines, we find in a paper read last year by Mr. Anstey, formerly of the engineering staff of the British navy, and now the manager of a firm manufacturing oil engines, the following statement: "The powers, however, which have been obtained per cylinder in engines whose design admits of application to propulsion are not large, probably not exceeding 100 horse-power, and, until the unit is largely increased, the very large powers required in many present-day vessels are out of reach of the internal-combustion engine, the immediate application of which would appear to be concerned mainly with the propulsion of boats and small vessels."

Commenting upon this paper, Mr. Whiting, Senior Chief of Construction of the Admiralty, stated that while questions of weight and space are of importance, in considering the motive power of a warship, it must not be forgotten that if a large number of units are installed to make up the total power, there are all sorts of difficulties connected with access, ventilation, and the removal of the products of combustion, which may well prove to be insuperable; while over and above these are certain subsidiary difficulties, such as the installing of such auxiliaries as the steering engine and the mechanism for working the heavy guns.

During the same discussion, Mr. Sillince, formerly in the Admiralty, now the manager of the firm in Great Britain which makes the Diesel engine, made the following statement: "With regard to future developments, I do not think we shall see battleships propelled by internal-combustion engines this year or next, and probably not within the next ten years. (The italics are ours.) Development will proceed in easier stages from smaller to larger sizes, the earlier experiences being applied to anticipate or eliminate difficulties in later applications; it being always borne in mind that the new competitor must start where its more fully developed predecessor left off." Later on in the discussion, Mr. Anstey, the author of the paper, complained that those who are engaged in developing the internal-combustion engine "sometimes feel that a great deal of harm is being done to its progress by misleading statements and claims which have not the remotest possibility of being substantiated."

Now, the readers of the SCIENTIFIC AMERICAN who recall that we recently announced the construction by the Hamburg-American Line of a 12-knot freighter which is to be driven by oil engines of three thousand combined horse-power, may be asking whether this great step in advance is not prophetic of the use of engines of large power in future ships. We reply that for the merchant marine, it undoubtedly is; but that there are certain advantages of the strength of construction of the hull and the more liberal space available, which render the problem far simpler for the merchant marine than it is for warship construction. The smokeless, funnel-less battleship is coming; but its day is not yet.

ENGINEERING.

The grand total of excavation during August on the Panama Canal was 2,813,462 cubic yards, of which 2,757,990 cubic yards were charged to "work excavation" and 55,472 cubic yards to "plant."

The magnitude of trans-Atlantic passenger travel shown by the recent arrival in the port of New York of one day of four ocean liners, the "Celtic," "Lapland," "Cleveland," and "Rotterdam," and two coastwise ships, the "Alliancia" and the "Vigilancia," which carried into port about 7,000 passengers, 3,589 being cabin passengers, and 3,393 being in the steerage.

The Public Service Commission, having finally settled the question of the new subway routes in New York city, is prepared, we understand, to consider the question of building a moving-platform subway as auxiliary to the main subways of the standard type. The advantages of the moving platform are its great capacity, which is nearly double that of any other type, and the frequency of the stations, which may be placed one on every intersecting street or avenue.

The agitation over the question of the fortifying of the Panama Canal is a veritable "tempest in a teapot." There is no existing treaty or understanding with other powers that would be violated by the erection of fortifications at each end of the strip of land owned by the United States, through which the canal is being built. We have guaranteed the neutrality of the canal, it is true; but it is our own property, and we have a perfect right to give it adequate protection, to do which will not in any way hinder our throwing the new waterway open at all times to the traffic of the world.

The excess of speed over contract requirements shown by our latest torpedo-boat destroyers is very gratifying. Although the contract calls for only 29½ knots, several of the latest vessels of this class have shown speeds of 32 knots and over. The latest success is recorded from the Delaware, where the oil-burning turbine-driven destroyer "Terry" developed 32.188 knots on her standardization trials over the measured mile course off Lewes, Del., in her recent trial. The "Terry" is the latest vessel for our navy to be completed by the Newport News Shipbuilding and Drydock Company.

Unless the huge ship which has lately been commenced for the Hamburg-American Line stops growing in dimensions, the 1,000-foot ship will be among us before we know it. The latest semi-official figures announced regarding this ship give her a length of 880 feet; but Mr. Boas, the general manager of the Hamburg-American Line in New York, is credited, in a recent daily press interview, with stating that the ship will be more than 900 feet long. This would look as though the 880-foot dimension was between perpendiculars. If so, a ship of this size would easily exceed 900 feet in her over-all dimensions on deck.

A comparative test was recently made in the armory range of the Thirteenth regiment, N. G. N. Y., of a Moore silencer and a Maxim silencer, attached to United States service rifles. So far as deadening the noise was concerned, the Maxim silencer demonstrated its superiority. When the range was darkened, it was observed that the Maxim silencer emitted no flame, while the flame from the other type was considerable. The reduction of the recoil was the same in both cases. The Moore type, which is 2¼ inches long, can be used with the bayonet on the gun, but with the Maxim silencer the bayonet cannot be used.

Although British locomotives, limited as they are by the narrower clearances of tunnels, bridges, etc., have never reached the size of locomotives in America, there has been a steady growth in dimensions, and some of the latest engines are extremely powerful. Thus, ten of the Atlantic type, built for the East Coast Scottish express use, have a total heating surface of 3,456 square feet, and a grate area of 27 square feet. The barrel of the boiler is 5 feet 6 inches in diameter, and 15 feet 10¼ inches in length. The tank has a capacity of 4,125 gallons of water, and five tons of coal. The total weight of the engine alone is nearly 90 tons.

The motor-driven warship is very much in the air these days. The English press is crediting the British Admiralty with the intention of building a dreadnought to be propelled by oil or producer-gas engines, and now a German paper, the Vorwärts, which is supposed to possess excellent sources of information, states that Germany is building a warship of the Monitor type, 284 feet long, with a freeboard of only five feet, and driven by internal-combustion engines, which is to have a single turret, exactly amidships, mounting two enormous guns of 16.7-inch caliber. The projectile is to weigh 2½ tons more or less, and the ship is to carry exceptionally heavy armor. Apparently the turret will be pierced by a short mast, upon which the conning tower is to be mounted. A speed of 27 knots is predicted!

AERONAUTICS

The French government is seriously considering a plan to explore Algiers and the Soudan by means of aeroplanes, for the purpose of ascertaining the most desirable locations for airship stations.

It is said that the Farman biplane entered in the Brigue-Milan contest was equipped with an engine of 100 horse-power, with the object of offsetting any speed advantage that the monoplanes might have. The machine is to be shipped to America.

The third member of the French team which is to come to America to participate in the contest for the Coupe Internationale d'Aviation will probably be Thomas. It has been decided definitely that Labouchère, on account of his injured knee, will not be able to come to Belmont Park.

The French aviator, M. Aubrun, broke all speed records on September 16th in a Blériot monoplane by flying 300 kilometers (186.4 miles) in 3 hours, 33 minutes and 7 seconds. At the end of the second hour he had flown 167 kilometers (103.7 miles), and at the end of the third hour 252 kilometers (156.59 miles). His average speed was about 55½ miles an hour.

Five thousand dollars will be offered to any aviator who reaches an altitude of 10,000 feet or more in the international aviation meet at Belmont Park. This is in addition to the grand altitude prize of \$3,000 offered by the aviation committee to the pilot who attains the highest altitude in the meet, and also the additional prize of \$1,000 if such altitude constitutes a record. The present record is 8,409 feet, held by Chavez.

Lieutenant Beaudin recently called attention to the fact that a flight from Algiers through the desert of Sahara is no more difficult than a flight of equal length in France. Moreover, there is no danger that the aviator will be lost in the endless sands, for he has simply to follow the telegraph lines, which lead to the very heart of Africa. In case he should meet with an accident, he could communicate with the nearest station by means of a portable telegraph apparatus.

The Paris correspondent of the Allgemeine Automobil-Zeitung states that he interviewed Morane at Havre shortly after he made his height record. Morane said that his 50 horse-power Blériot could not possibly go higher than 2,500 meters, because the power of the motor diminished with increasing height. He ventured the opinion, however, that with a 100 horse-power motor he might be able to go up as high as 3,500 meters. This was later borne out at Deauville, where at a height of 2,592 meters, Morane's motor stopped. Chilled to the bone, he glided down without accident.

A new 60 horse-power aeroplane motor has been placed on the market by Robert Esnault-Pelterie. On an official test made at the Aero Club of France, this five-cylinder, fan-shaped motor gave a good account of itself. The oil lubricant is circulated on the forced-feed principle. The double igniter receives its current from a specially constructed magneto. The total weight of this 50 to 60 horse-power motor is 150 kilogrammes. During a test lasting ten hours and two minutes continuously the motor consumed 193 liters of gasoline and 24 liters of oil, which is a consumption per horse-power per hour of 270 grammes of gasoline and 41 grammes of oil.

The Voisins have radically changed their biplane. A tubular frame is used and the elevation rudder, which was formerly in front, has been entirely removed. The horizontal surface at the rear acts both as an elevator and as a stabilizer. Evidently the Voisins have adopted the Wright brothers' idea. In the new Voisin machine, the aviator is seated on the lower plane. The system of control has been modified. A lever, somewhat like those used on automobiles, operates the elevation rudder, while a wheel is employed to control the ailerons. Presumably the wheel also manipulates the tiller ropes of the vertical rudder, although we have seen nothing in the French technical press that bears out that supposition.

Of the thirteen balloons which left Indianapolis late Saturday afternoon, September 17th, nine participated in the elimination race to select the American representatives in the international contest a month later. Nearly all the balloons traveled eastward across Ohio and Pennsylvania. The winner, the "America II," of Messrs. Hawley and Post, landed at Warrenton, Va., 460 miles from Indianapolis, at 2:20 P. M. on Monday. The aeronauts only descended when they drifted within sight of Chesapeake Bay, after remaining aloft 44 hours and 26 minutes—three hours less than the American endurance record. Second and third places on the team will probably go to H. E. Honeywell's "Centennial" (formerly the "St. Louis"), and Louis von Phul's "Million Population," which, according to first measurements, covered 385 and 380 miles, respectively. J. H. Wade's "Buckeye" covered 375 miles. All the balloons passed through heavy rain storms, and their occupants reported having had one of the worst trips they had ever experienced.

ELECTRICITY.

Our Vice Consul-General at Hong Kong writes that the Chamber of Commerce of that important port is strongly urging the establishment of a wireless telegraph station. At present there is no such station equipped for commercial service, notwithstanding the fact that a large number of the vessels that regularly enter that port are equipped with wireless apparatus.

A farmer in Texas has decided to experiment with the use of electric light for stimulating vegetable growth. He has arranged to procure power from a neighboring plant by which he will supply a network of tungsten lamps, placed 150 feet apart all over the fields. These will be illuminated all night, and it is expected that they will increase the growth of the crops.

According to a recent note in the Electrical Review and Western Electrician, the Pennsylvania Railroad is experimenting with the use of the telephone for communication between the locomotive cab and the caboose of long freight trains. This will do away with the necessity of signalling by means of lamps, hand signals and whistles. Certainly in foggy weather, at night, such a means of communication would materially expedite the handling of freight.

The total water power of the State of New York, without including that of the Niagara and St. Lawrence rivers, has been estimated at a million and a half. Eight hundred and eighty thousand of this is undeveloped. The New York Water Supply Commission has recently recommended that the State expend \$20,000,000 to develop this water power, which it estimates would return an annual profit of \$1,400,000.

A very striking electrical sign has been set up in Denver. The sign represents a skyrocket shooting from the ground to a height of 150 feet, where it explodes into hundreds of sparks that fall in a shower to the ground. This effect is produced by successively illuminating a string of lamps running up the side of the building to the top of a tall framework on the roof. Over a thousand lamps are used to produce the effect.

A novel method of cutting down trees has been devised by a Berlin inventor. It consists in the use of a fine steel wire, which is looped about the tree and sawed back and forth by an electric motor. The heat generated is sufficient to burn a thin kerf through the wood. A tree 20 inches in diameter can be felled in six minutes. The charred butt of the tree may easily be marked with chalk, and the charcoal layer is so thin that it does not hide any decay or other defects in the wood.

Poles of first-class Michigan cedar will soon be a thing of the past, according to Mr. E. L. Clark, who spoke recently before the Electrical Club of Chicago. As a substitute for Michigan cedar, either steel or concrete poles must be used, or the electrical engineer will have to overcome his prejudice against western cedar. By treating the pole with preservative materials, its life may be greatly increased. Mr. Clark recommends that the butt of the pole be immersed in hot compounds at, say, 205 deg. F., for eight minutes. This treatment would poison the food supply of such germs as are liable to attack the wood.

For many years, says our consul at Genoa, the telegraph tolls in Italy have been considerably higher than in other parts of Europe. The telegraph service of the country is owned by the government, and the principal reason for not reducing the rates has been the fear that the lines would be unable to handle increased business resulting from lower rates, and unless there were such increase, the receipts would be diminished. The Ministry has recently added 25,000 miles of wire to the telegraph system, with 39 new direct communications between large centers, and has installed 1,200 new, high-capacity instruments. This has made it possible to reduce the tolls, and a law to this effect will go into effect on December 1st.

In the effort to find a simple portable standard of comparison for photometry, Messrs. W. T. Vivian and George W. Huey have carried out a series of experiments in the Department of Electrical Engineering of the University of Nebraska with phosphorescent substances. They have succeeded in securing very satisfactory results with a phosphorescent paint known to the trade as Balm's paint, and have described their work in a recent number of the Electrical World. They find that the paint when exposed to sunlight for ten seconds receives its maximum excitation, and that further exposure does not appear to increase the intensity of the phosphorescence. They discovered, however, that temperature plays an important part in the luminosity of the paint, and in order to secure standard results, they kept the paint at a temperature of zero Centigrade by applying it to the walls of a tin can filled with cracked ice and water. By comparing this standard with a standard lamp, they found that the error did not exceed eight per cent, part of which could be accounted for by the fluctuations of the lamp due to unsteady voltage.

A NEW IDEA IN SLEEPING CARS

BY M. M. HUNTING

Those who are forced to take advantage of the meager comforts of the railroad sleeping car will rejoice to learn that at least one transportation company is anticipating interference by law, and is providing the public with something novel in car service in proportion to what they pay.

With this new design of car, real comfort is furnished at the usual rates of the lower berth, while those who are willing to accept an "upper" find at least better accommodations than those provided by other cars, and at a reduced price to compensate for the difference.

A sleeping car on an inter-urban line is not an entirely new thing in this country, but such cars as are now being operated daily between Peoria, Ill., and St. Louis, Mo., are proving a boon to the traveler as well as something of a curiosity.

Upon entering a compartment to prepare for the night's rest, one finds that the bed to be occupied is folded snugly into the wall and that a chair, placed in a comfortable space, is waiting for the passenger. If the upper berth is not sold it is not let down, which permits of standing upright if desired. When ready to retire the cot is drawn out from the wall, and if tall, you will find to your great relief that it is six inches longer than any berth you have ever occupied, and permits of stretching out to full length.

In the wall at the head of the bed is an electric light, which obtains its current from a storage battery and not from the trolley. With this arrangement the light burns with the same uniformity at all times, and makes it possible for one to read after retiring if wishing to do so.

A small wall safe is also provided in each compartment, for the protection of money or other valuables. This in itself is a unique and a valuable addition to the sleeping car. Upon arising in the morning the cot is again folded into the wall, and the small camp chair is again used while dressing. The toilet rooms at each end of the car are roomy and well equipped, and after the preparations for the day are over you return to your berth, when the thoughtfulness of the company surprises one still more, for you are served by a porter with hot coffee and rolls with butter, free of charge. We are told that he is amply paid, and the company does not permit him to accept any tips.

If during the night it has been your lot to occupy an upper berth, you find first of all that it has a window supplying light and fresh air. Besides this, the curtains for this berth cover it sufficiently to exclude the annoying glare of the chandelier, which is found in the ordinary sleeper.

The noticeable absence of cinders and smoke renders the trip an enjoyable one, while the company's forethought in having the sleeper drawn behind another car, so that the noise of the motors cannot be heard, leaves almost nothing to be desired that could be reasonably expected.

Cars leave both terminals of the road each night about retiring time, and arrive at their destination at a reasonable hour the next morning.

A new method of constructing the foundations of buildings in order to prevent, as much as possible,

earthquake shocks from being communicated to the buildings has been devised and patented by Dr. J. A. Calantarients, of Scarborough. In this system the foundation, which is built in the usual manner, is faced with hard material such as granite or iron, and upon this facing layers of talc, mica, or other smooth substances are deposited, each layer being dusted with



The sleeping car berths are folded into the wall.



The pillows are kept in racks in the wall, and not packed on the floor as in most sleepers.

powdered talc, mica, asbestos, soapstone, or sand, or mats of asbestos, etc., may be used without the plates of talc. Slabs of granite or iron placed on this prepared zone form the base of the superstructure. The object of the arrangement is, in the case of an earthquake, to allow the building to slide laterally. Means are provided for rendering the service pipes flexible at the point where they issue from the ground.

Paper from Grape-Vine Stems.

BY DR. ROBERT GRIMSHAW.

Although the grape industry is not one of the principal sources of wealth of America as it is in Germany

From the botanical point of view, the vine differs from ordinary tree branches only in a few unimportant details. The amount of cellulose in the two is about the same. For the manufacture of paper any substance can be employed which may be changed partly or wholly into fibers and form cellulose, and the fibers of which are sufficient. Concerning his experiments with the vine, Chaptal says he cut the dried stems into pieces of convenient length and treated them with hot diluted aqua regia (nitromuriatic acid). The resulting product he triturated slightly with water and passed it through a sieve, obtaining a brown pulp composed of spindle-shaped fibers of cellulose of different but sufficient lengths. Treating the stems with alkalis gave about the same results. According to these experiments there can be obtained from dried stems, by suitable reduction in size, a product which answers all the requirements of a good paper pulp.

As regards the industrial and economic side of the question, La Nature gives some data concerning the comparative values of the different raw materials in France. The wood employed for paper-making, mostly fir, birch, aspen and sycamore (platanus) costs Fr. 7.00 per cubic meter, or Fr. 2.00 per 100 kilogrammes. Assuming that the vine stems yield 50 per cent as much paper pulp, in proportion, as the wood, their worth would be at least Fr. 1.00 per 100 kilogrammes, which would correspond to Fr. 15 per hectare of vineyard.

The cost of manufacture would probably be higher than in the case of wood, as there would be more raw material required for an equal weight of pulp. As against this, the treatment of the vine-stems seems to be attended with less difficulty, and therefore to be more economical than that of wood; so that the total cost of manufacture would be in the two instances about the same, and the vine-stems should bring Fr. 1.00 per 100 kilogrammes. It would not, however, pay to transport them far, by reason of their low value in comparison to their bulk; so that the pulp must be made in the immediate neighborhood of the vineyards.

The manufacture of the pulp into paper would be about the same as in the case of wood pulp; but according to Chaptal's experiments the treatment with alkalis gives the best results. The bleaching of the pulp is best effected by chlorine.

The double advantage of the discovery or investigation—namely, the utilization of the vine-stems and the finding of a substitute for the rapidly diminishing supply of rags and

other paper-making material—should make this subject of general interest.

To the Bulletin of the American Geographical Society, Mr. Robert M. Brown contributes an interesting series of diagrams showing the maximum, minimum, and average levels of the waters of the Mississippi system at five stations—Hannibal, on the Mississippi; Hermann, on the Missouri; St. Louis, just below the confluence of the Mississippi and Missouri; Cairo, on the Ohio; and Memphis, Tennessee. The varying influence of the different types of rainfall occurring in different parts of the drainage area is clearly shown.



A NEW TYPE OF SLEEPING CAR WITH UNIQUE AND COMMENDABLE INTERIOR FEATURES FOR COMFORT IN TRAVELING.

and France, still the possibility of using waste material such as grape-vine stems should not be without interest in the States; and this possibility is offered by an invention that is giving the French and Germans great pleasure, especially as at the present time the wine industry is languishing in both countries.

Mons. Chaptal, professor of general and applied chemistry in the agricultural school at Montpellier, has been making extensive experiments concerning the possibility of making paper out of vine-stems. This is all the more welcomed, as the supply of raw material for paper-making is getting scarcer every year.

The Production of Concrete Pipes by Centrifugal Action

BY DR. ALFRED GRADENWITZ

Owing to the ever-increasing use of iron concrete in the most varied branches of engineering, endeavors have been made from time to time to produce pipes

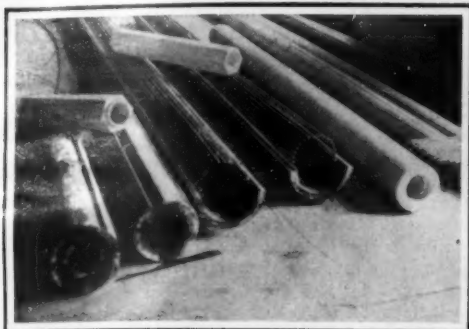


Fig. 2.—Another kind of metal skeleton consists of tube-shaped plates of "expanded" metal.

and poles of this material. However, in the casting, as well as in the stamping or compressing of concrete, an excess of water over the amount required for binding will remain in the mass, while the density of the product is never uniform. In fact, during the casting



Fig. 3.—The axis of the inclined mold.

process, the heavier components will sink to the bottom and the lower strata will undergo the action of the weight of the upper ones, so that the cast material shows, in an upward direction, a uniformly decreasing density and strength. During the stamping process the mass is struck only at a single point and only intermittently, so that the plastic material can escape freely in all directions.

Furthermore, the excess water present in the mass is removed only temporarily by the stamper. Similar conditions are obtained in the compressing of concrete.

According to a new process designed by the Deutsche Schleuder-Röhren-Werke at Meissen, Saxony, pipes, poles, etc., are produced by a centrifugal action exerted on a plastic mass, preferably concrete, in rapidly rotating molds. In order to in-

crease their strength, these tubes can be fitted with a metal skeleton rigidly and entirely imbedded inside the mass.

As raw material, any matter can be used which is susceptible of being worked to a plastic pulp, and of being hardened. However, as above mentioned, cement is the material most generally used; sand, gravel, stone-grit, or dissolved fiber (such as asbestos, slag-hair, and the like) well mixed and stirred so as to form with water a thick liquid being employed as admixtures.

The metal skeleton (Fig. 1) is mainly formed by substantial longitudinal rods of rolled steel of a strength of 6,000 to 7,000 kilogrammes (13,228 to 15,432 pounds) per square centimeter (0.155 square inch) which are transversely cross-braced by an inside and outside spiral coil of thin iron wire. At the crossings, the longitudinal rods are connected together and with the two wire coils by iron wire, so as to form a substantial system.

Another kind of metal skeleton (Fig. 2) that can be used consists of tube-shaped plates of "expanded" metal, which are connected alongside their longitudinal seam with wire, or by autogenous welding. The design and dimensions of the iron skeleton should be adapted, on the basis of statical calculations, to the strength required from the sample.

This iron skeleton is inserted into a double-section detachable tube mold. In order to lie concentrically in this mold without touching it, the iron skeleton is provided at its outside circumference with some uniformly distributed narrow and short guiding rods, consisting of the same mass as the sample to be produced, and containing a stiffening wire frame.

After then having been filled with a convenient amount of cement mortar, the mold is closed and introduced into a patented centrifugal molding machine. This, as inferred from Fig. 4, consists of several individual machines, identical with one another, which are installed at convenient distances apart. Each machine comprises two substantial side walls, with a circular cavity in the center. Concentrically round this cavity, and at equal distances apart, are located three shafts, adjustable in a radial direction. On each

of these shafts are mounted two wheels, and between the three pairs of wheels rolls a tube, penetrating through the central cavities in the two side walls,



Fig. 4.—The centrifugal molding machine for holding the mold, comprises several individual machines,

which is provided laterally with self-centering tightening devices similar to the chucks of lathes.

Now, all these individual machines, which are accurately aligned, are operated uniformly and in common, from a transmission shaft, so that the chucks of each machine, which are rolling between the wheels above mentioned, may serve immediately as belt pulleys. In front of and behind the machine, as well as between the several sets, are arranged trains of idlers, the former being stationary, while the intermediary idlers between the various units are installed on a common frame susceptible of a vertical displacement by means of a level transmission.

The centrifugal action occurs as follows: After lifting the train of idlers, the filled mold is introduced. (Continued on page 264.)

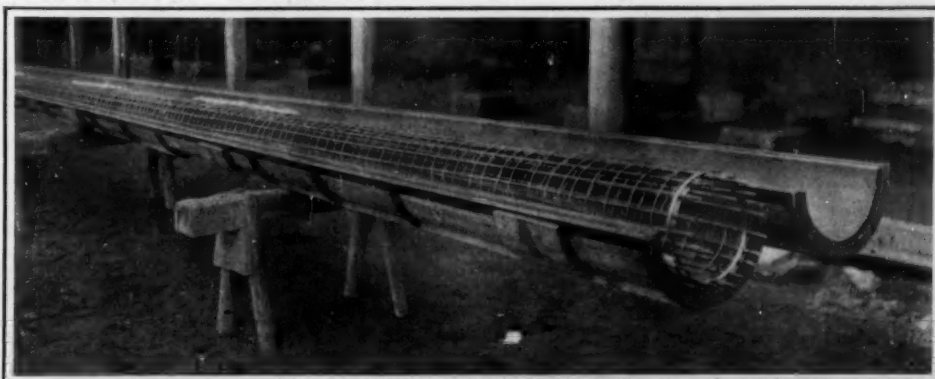


Fig. 1.—The metal skeleton strengthens the concrete tube, and is mainly formed of rods of rolled steel and cross-braced by spiral coils of wire.

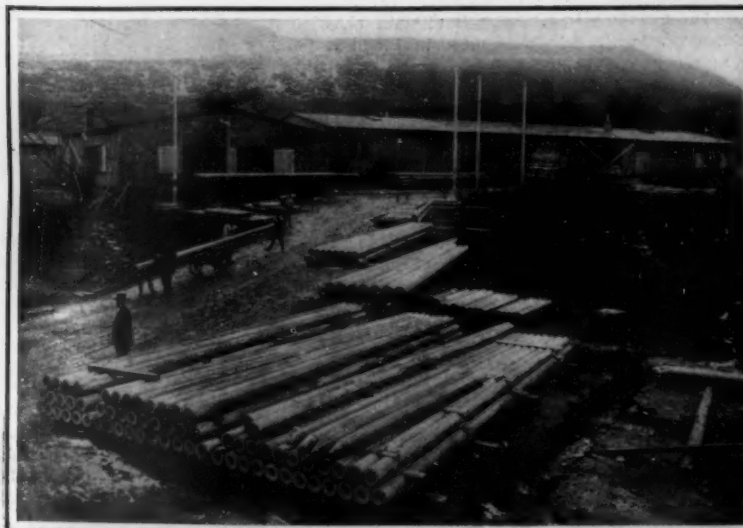


Fig. 5.—Tubes produced by centrifugal action at the Deutsche Schleuder-Röhren-Werke, Meissen, Saxony.



Fig. 6.—View of Augustus Bridge, Dresden, showing concrete poles.

THE PRODUCTION OF CONCRETE PIPES BY CENTRIFUGAL ACTION.

MAGIC FOR AMATEURS—XII

MYSTIFYING WATCH TRICKS

BY W. H. RADCLIFFE

NO. 28. THE FLIGHT OF TIME.

Time flies when one is being entertained by the magical tricks here presented. To prove from a scientific standpoint that such is actually the case, borrow a watch, preferably a small open-face watch, from one of the audience, and allow the owner to place it glass downward in the box shown in Fig. 42.

This box should be about three inches long, four inches wide, and two and one-half inches deep. It should be provided with a hinged cover *m*, and preferably with a lock and key *n*. The tricky part of this box is the side *s*, which is pivoted at *t* by driving two short wire nails into it, one through the front side and the other through the back side of the box, so that when *s* is pushed in at the top and pulled out at the bottom, it swings around as shown and allows the watch placed inside to slide out into the performer's hand when the box is slightly tipped sideways. The side *s* should fit rather tightly when closed, so that the box may be examined without betraying its secret. As the side *s* extends down to the bottom of the box, it facilitates the use of the fingers in pulling outward at the lower part while the thumb is pressing inward at the upper part. To remove suspicion, the side of the box opposite *s* should be built up in the same manner, but not pivoted.

For the reproduction of the watch use a flat-bottom tumbler *A*, Fig. 43, containing an inner cone *B*. The cone is made of cardboard, pasted together so that it fits easily within the tumbler; it is closed except at

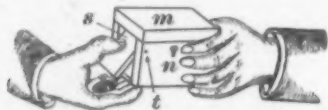


Fig. 42.—THE BOX WITH SWINGING SIDE. EASY TO MAKE AND USEFUL IN CONNECTION WITH WATCH TRICKS.

the bottom, and should have bran pasted over it, so as to effectually hide its entire outer surface. A small cork *c* is tied to it by a thread. To prepare this part of the apparatus for use, place the tumbler, with the cone inside, upon a table somewhat in the background. On top of the cone put some loose bran, and let the cork hang down on the side of the tumbler away from the audience. A napkin or large handkerchief should also be laid beside the tumbler.

After the watch has been placed into the box, Fig. 42, the performer takes the box in his left hand, and in the act of locking it with his right hand, secures possession of the watch in his left hand, as previously explained. Tossing the key to the owner of the watch, the performer places the box on a chair or table near the audience, and with the watch securely palmed, walks back to get the tumbler. Standing directly in front of the tumbler with his back toward the audi-

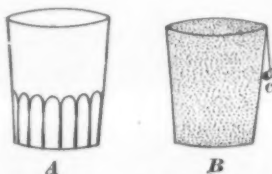


Fig. 43.—A TUMBLER WITH INNER CONE PROVIDES A MEANS OF SPRINGING SURPRISES.

ence, the performer quickly raises the cone with his right hand, lays the watch glass downward so as not to scratch the case, in the bottom of the tumbler, and replaces the cone.

The loaded tumbler and the napkin are then brought forward, and the former is placed in full view of the audience with the cork hanging down behind it. The performer calls attention to the tumbler being full of bran, and picks up some of it from the top to substantiate his statement. He then spreads the napkin over the tumbler, commands the watch to pass from the box into the tumbler, and the bran to disappear, repeating the words "Presto! Change!"

The box is then handed to the owner of the watch, so that he may unlock it with the key he holds. As soon as the box is found to be empty, the performer grasps the napkin spread over the tumbler, and through it the cork tied to the cone. Raising the napkin carries up the cone within it, leaving the watch to be returned to its owner.

NO. 29. MIND READING EXTRAORDINARY.

As a brain teaser, the watch trick here described ranks ace high. Request someone to think of one of the numbers from one to twelve on the dial of your watch, and ask him to add one to it every time you tap the crystal over the dial with a pencil (see Fig. 44) until he reaches twenty, and then to notify you. Tell him that by the twentieth tap you will have read his

mind so accurately that you will then strike the number he first thought of, without asking any questions.

The method of doing this trick is very simple. For the first seven taps you may strike at random any of the numbers on the watch dial, but at the eighth tap strike twelve, at the ninth eleven, at the tenth ten, and so on around backward until you are notified by the chooser that he has reached twenty in his count.

If the instructions have been properly followed, the pencil will then rest upon the chosen number, because if twelve—the highest number that can be taken—is chosen, eight taps will bring it to twenty, so that your pencil according to instructions will then be on twelve, and any other number selected on the dial will be less than twelve by just the amount that will cause the pencil taps to shift backward from twelve to the thought-of number, when the count of twenty has been reached by the chooser.

The interest in this trick can be magnified if the mind-reader invites several persons (as many as can get around a large table) to think of a number on the dial. The trick can be as successfully and as easily performed for a group of a dozen as for one at a single operation. Another addition to the trick is the fact

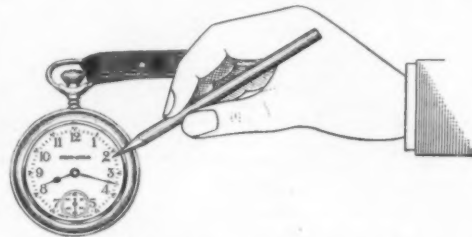


Fig. 44.—METHOD OF GUESSING THE NUMBER THOUGHT OF ON THE DIAL OF A WATCH.

that the number twenty, to be reached as set in the description above, can be changed to any number beyond that base, and a few numbers below it. If twenty-five, the mind-reader's random taps are five more than seven; if thirty-one, eleven more; if eighteen, two less than seven, and so forth. The handling of any number of persons by the mind-reader and the shifting of the base number can be readily done without a mistake on his part.

The First Aeroplane Flight Across the Alps.

After a week's wait and the making of several unsuccessful attempts, George Chavez, the young Peruvian who recently broke the height record with his Blériot monoplane, at length succeeded, on Friday, the 23rd ultimo, in accomplishing the daring feat of flying over the Simplon Pass in a heavier-than-air machine. In an attempt earlier in the week he had risen to a height of 7,500 feet, but had been so buffeted by the wind when he tried to fly through the pass that he was obliged to descend. This attempt had been made as soon as a report was received that the weather was clear though somewhat windy. Chavez, remarking that he did not mind the wind so long as he could see his way, jumped into his monoplane and rose rapidly in spirals. He soon disappeared over the mountain, only to reappear and descend again a few minutes later. Upon alighting he shook his glove to show how he had been tossed about by the wind. He stated that he kept his seat with difficulty and had all he could do to keep the machine from upsetting. This attempt taught him that wind in the pass would prevent him from making the flight, and so he waited eagerly for calm as well as clear weather conditions. Last Friday, as soon as the report was received that such conditions prevailed, Chavez made a trip from Brigue (Switzerland)—the starting point of the trans-Alpine race to Milan—to the Simplon Pass with Louis Paulhan in an automobile, in order to see for himself that the weather was propitious. Immediately upon his return he climbed into his Blériot, fastened a barograph and a map in front of his seat, and, remarking that he would never have a better chance, ordered his motor started. With a run of less than 100 feet, his monoplane rose from the 900-foot-high plateau above the town of Brigue and flew straight out over the valley. It rose gradually in circles and had a beautiful and bird-like appearance as it at length soared among the highest peaks and disappeared from view. The start occurred at 1:30 P. M. At 1:48 word came from the hotel at the summit of the Simplon Pass that Chavez had passed above it at a height of 1,600 feet. At 2:11

P. M. the daring aviator landed at Domodossola, Italy, some 25 miles from Brigue, after a long glide of 3,000 feet. Just before alighting, and when only 50 feet from the ground, Chavez apparently started his motor again. Instantly the wings of the monoplane turned upward and the body of the machine fell like a stone to the ground. Chavez sustained severe bruises on his head notwithstanding his heavy felt skull cap. Both his legs were broken, the left one in two places, and his thigh was also fractured. Despite these severe injuries, the doctors believe that he will recover.

This accident to Chavez's Blériot was like that which happened to an Antoinette monoplane at the Rheims meet, resulting in the death of Wachter. As in Wachter's case, the aeroplane had undoubtedly been strained by battling with the heavy winds, and when power was applied suddenly at the end of the long descent, a heavy strain was thrown upon the wings, which caused the guys to break. The chief difference between the two accidents was that Wachter descended under full power, while Chavez made a long glide and came to grief only when he switched on the power suddenly at the end of his descent. The two accidents have demonstrated that there is not a sufficient factor of safety in most monoplanes, especially when they are put under extraordinary strains, as is sometimes the case.

The flight across the Alps marks a new stride in aviation, as it has shown that the aeroplane can be used for quick transportation in inaccessible and mountainous country. To reach the summit of the Simplon Pass from Brigue a high-powered automobile requires 1½ hours, while Chavez accomplished this in but 18 minutes. As soon as some method is perfected of keeping an aeroplane stable in high winds, such for instance as the gyroscope, aviators will be able to fly over mountainous country without much difficulty, despite the high winds which generally prevail.

Weymann, the American aviator, in a Farman biplane, was the only competitor of Chavez. He mounted to a high altitude several times, but was unable to reach a sufficient height, last Friday, to fly over the pass.

Maté Plant, a Tea Substitute.

Recent reports as to the maté plant show that it can be used as a substitute for tea or coffee. Different species of the Ilex, from which the leaves are obtained, are found in Paraguay, Brazil and Argentina as well as in other regions of South America. The leaves are collected by the natives either from the wild plant growing in the forests, or from cultivated plants. After drying upon racks for 20 hours by a slow fire, the leaves are ground or crushed by using a stone or wood implement. The natives make an infusion of the leaves in about the same way as a tea infusion, using a calabash for the purpose. Although it is much employed by the natives of these regions, it appears to be little known elsewhere. However, efforts are being made in Brazil to put the product on the market in Europe and especially in France. Analysis shows that it contains tannin, one or more kinds of saccharine matter, salts, etc.; also caffeine, to which is due its special properties such as we find for coffee and tea, so that it is to be classed along with these. As to the physiological effects of the infusion, these are about the same as are produced by tea. The maté has about 2 per cent of caffeine, which is somewhat less than tea contains. It has an agreeable aroma and a pleasant taste, although somewhat bitter. The infusion is made very easily by pouring on just enough boiling water to moisten the leaves, leaving for a few minutes and then adding the rest of the boiling water. From 10 to 15 minutes is enough for the infusion.

Varnish for Models and Machine Parts.—(a) Models: 15 parts shellac, 5 parts Manila copal, and 5 parts Zanzibar copal, are placed together in a kettle, inclosed in a wooden tub, a space of ¼ of an inch between tub and kettle, serving to contain heating steam, generated in a separate boiler. In 4 to 6 hours the melting will be completed. Add 75 parts of the finest potato spirit, heat the whole to 87 deg. C. (189 deg. F.), mix with orange color. (b) Machine parts: 17.5 parts shellac, 2.5 parts Cocoriel copal, 5 parts Zanzibar copal, 75 parts finest alcohol.

Correspondence.

THE PERPETUAL MOTION PROBLEM.

To the Editor of the SCIENTIFIC AMERICAN:

Regarding "A Perpetual Motion Machine Problem," in your edition of the 17th ultimo, I would say the reason the machine will not operate is that, although the buoyancy of the vessels on the left side may be greater than that of those on the right, there will always be more of the weights acting downward on the left side, no matter how many the total number of vessels may be on the machine, provided they are spaced evenly. This is due to the fact that the vessels become longer on the left side. Turning around the pulleys the weights will be further from the center on the left than on the right side, which will overcome whatever greater buoyancy the vessels may have on that side.

H. F. CHAMBERLAIN.

Warwick, N. Y.

To the Editor of the SCIENTIFIC AMERICAN:

Regarding the perpetual motion machine described and illustrated on page 214 of the September 17th number of your paper, lest the inventor be working under a misapprehension, I want to say that if he takes a vessel filled with air and submerges it in any liquid, there will be no lifting force exerted on the vessel by the air. The liquid presses on all sides, the top, and the bottom of the vessel. The pressure on the sides is equal, so there is no tendency to motion in a horizontal plane; but as the pressure increases with depth, the pressure on the bottom is greater than that on the top, and the difference between these two pressures is the value of the force tending to lift the vessel.

If the inventor submerges a vessel with a liquid-tight, flexible cone for a bottom, the pressure on this bottom will extend it inward and upward. If he puts a weight in the vessel great enough to extend the cone downward, it must be great enough to overcome the upward pressure of the liquid; consequently, neglecting the weight of the vessel and the infinitesimal weight of the contained air, the only force having any effect on the vessel will be the downward pressure of the liquid on top. The vessel should go down rather than up, as the inventor hoped. If he applies this theory to all the vessels on his machine, he will find it is *very nicely balanced*, and the surprise would come if it did work.

ELMER D. TUTHILL.

Mattituck, N. Y.

To the Editor of the SCIENTIFIC AMERICAN:

I believe that I have found the fallacy in the perpetual motion machine described in last week's issue of your paper. It is as follows: Although the four canisters on the left side of the belt are more buoyant than those on the right, their energy is canceled by the backward pull of both top and bottom canisters, as they do not change from their relative positions until several degrees past the turning point. Should they change from the collapsed to the distended position on reaching the horizontal, perpetual motion would indeed be solved, but this seems to be the trick yet to be done.

WINTHROP H. MORTON.

Hartford, Conn.

To the Editor of the SCIENTIFIC AMERICAN:

The Horton chain of buckets would not turn because the excess air on the left-hand side would exactly balance the excess fall lift as each bucket left the top and bottom. In other words, when the ball falls out at the bottom and in at the top, just that much work is lost by the drop from the top and added to the lift at the bottom as the machine turns from left to right.

JOSEPH E. BISSELL.

Pittsburg, Pa.

To the Editor of the SCIENTIFIC AMERICAN:

I note with interest the problem in perpetual motion presented on page 214 of the SCIENTIFIC AMERICAN, issue of September 17th, and I desire to offer the following as the apparent reason why the device will not operate:

From an inspection of the illustration, it would appear at the first blush that there would be a tendency to motion in the direction of the arrow, due to the difference in buoyancy between the vessels on the left-hand side and those on the right-hand side. There is, as a matter of fact, such a tendency, but this tendency is overcome by a constant pressure, the source of which I will proceed to explain. Let us assume that one of the vessels is so placed on the periphery of the lower disk that its flexible cover is about to pass from its collapsed to its distended state, and at the same time let us suppose that one of the vessels is so positioned on the upper disk that it is about to pass from its distended to its collapsed state. Now the total pressure on the surface of the collapsed lower cover is equal to the head of water on the center of gravity of that surface times the area of that surface projected on a plane surface at right

angles to the axis of the first-mentioned surface times the weight of one cubic unit of water. The difference in the pressures on the surfaces of the covers of the upper and lower vessels will be equal to the weight of a column of water whose height is the difference in head on the centers of gravity of the two covers and whose cross section is equal to the projected area of one of the surfaces. This difference in pressures then would always resist the tendency of the cover of each vessel to pass from its collapsed to its distended state as it passed around the lower disk, and this pressure would counteract and overcome any tendency to motion due to the difference in buoyancy, even if the vessels were increased to an infinite number.

Washington, D. C.

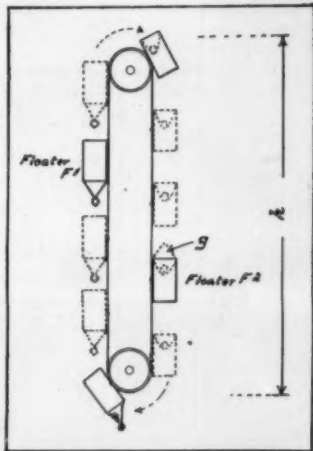
J. H. WATERS.

To the Editor of the SCIENTIFIC AMERICAN:

I submit the following explanation of the fallacy in the perpetual motion machine shown in your issue of September 17th, 1910.

When the floaters move in the direction given by the arrow the ball will, if sufficiently heavy, hang down when going up and fall into the floater when going down, irrespective of the air pressure in the floaters or the hydraulic pressure upon their outside.

Floater F_1 will have a larger displacement than the floater F_2 ; the difference in displacement is represented by the weight g of a water cone, which can assume as resting on F_2 ; g and F_2 taken together will then have exactly the same shape as F_1 . The excess weight g will tend to start a motion and will, if such takes place, perform the work $g \times h$, when F_2 sinks from its highest to its lowest position. When now the ball falls out, a quantity of water, the weight of which is again g , must be pushed out, and this requires work. At the same time the floater in the highest



THE PERPETUAL MOTION PROBLEM.

position will be filled in, and we could say that the quantity of water pushed out, which must escape somewhere, is raised through the height h and then filled in; but this process requires the work $g \times h$.

To express it more plainly: On each down-going floater is placed a load g , performing the work $g \times h$; in order to keep the machine going we have to raise the loads again to the highest position, and thus exert the same amount of work $g \times h$, which neutralizes the work $g \times h$ going down. The actual neutralization takes place at top and bottom in the pushing out of the water from the floater at the bottom and in the flowing in the same amount of water at the top.

New York, N. Y.

SIMPLEX.

The Current Supplement.

The current SUPPLEMENT, No. 1813, opens with a most interesting article by the Paris correspondent of the SCIENTIFIC AMERICAN on a new principle in the Leblanc Refrigerating Process. The new system is being used by the French navy in some of the new battleships in order to cool the ammunition in storage quarters.—"Aeroplane Accidents and Their Lesson" is the title of an article in which wholesome advice is given on the proper construction of flying machines, and some sound criticism directed against the modern monoplane.—"Lieut. Johannes Engel writes on the Aerial Torpedo. The subject is particularly timely, because the Krupp's are said to have acquired an option on the patents of the Swedish Colonel Unge for aerial torpedoes. The experiments which the firm has carried on with these projectiles have reawakened interest in a weapon which possessed great military importance until the middle of the nineteenth century, namely, the rocket. The article considers the principle in detail.—"Mr. J. Stormonth writes instructively on Rope-Driving.—"The Physics of Diving is an interesting article on a queer profession.—"Mr. E. D. Sewall writes on the Status of Process Inventions from the patent lawyer's standpoint.—"Mr. J. R.

Schauer contributes an instructive article on Some Beautiful Specimens of Marine Vegetation.—"The Metallic State is discussed by E. E. Fournier d'Albe.—"Recent Developments in Diesel Oil Engines are reviewed.—"The usual Engineering Notes, Electrical Notes, and Trade Notes and Formulae will be found in their customary places.

Larsen's Passage of the Whirlpool Rapids.

Captain Klaus Larsen, with his boat, the "Ferro," passed through the Whirlpool Rapids on September 18th. Larsen came out of the experience with an injured leg, and his boat much shaken, with eight inches of water in her hold. The boat entered the seething drift a little to the Canadian shore, with the velocity of an express train, rode up to the crest of the great wave opposite Whirlpool Outlook, shot into the air fully twenty feet, and came down with a smack that could be heard on the railroad bridge above the roar of the waters. The boat keeled over and Larsen was half covered in the spray. If it had not been for the 900 pounds of ballast which Larsen had wisely taken on board, the boat could not possibly have righted herself. As it was, she came up on an even keel very quickly, plunged into the next roller, keeled over, spun around and righted herself again. Three waves were then met stern first. The boat shot toward the Canadian shore and rammed her nose on the rock. There she hung, swaying and tumbling, with every likelihood of going to pieces. Larsen pulled her off by leaning well toward the stern and working the tiller to and fro. Sliding back into the water, the craft was caught in the current and carried over toward the Whirlpool with her engines still going. In that boiling maelstrom Larsen lost his bearings. He mistook the arm extending into the old St. David's Ravine for the right course, and discovered only too late that he was running right into the mouth of the maelstrom. Here his engine stopped, and Larsen found himself at the mercy not only of a mass of rushing, swirling water, but of debris and pounding logs. Fortunately, a cross current caught the boat and carried it free of the drift wood, swung her free of the pool and started her stern first toward the lower stretch of the rapids. The remainder of the journey was safe enough. About a mile from Lewiston the boat drifted in toward the American shore and lodged on a shelf of rock. Here she was abandoned. Larsen swam ashore. Freed of his weight, the boat floated off the rock and was picked up at Lewiston ten minutes after her abandonment.

The "Ferro" is a boat 18 feet long, fitted with an 8 horse-power engine. Her beam is 5½ feet. She is entirely decked over, with the exception of a small circular hole which serves as a cockpit. During his course down the rapids, Larsen tacked a canvas over the hole and fastened it around his waist so that no water could enter.

Larsen's "Ferro" is the second engine-propelled craft to navigate the Whirlpool Rapids successfully. The old "Maid of the Mist" was sent through in 1864 to avoid confiscation.

The International Convention for the purpose of regulating international aerial traffic has now proceeded so far in its work that at least fifteen of the questions which were assigned to it for consideration have been definitely answered. Most of the governments have agreed to distinguish two classes of airships, public and private, the first including airships in military or other governmental service. Private airships must first be inspected before they can receive a license. The convention has unanimously decided that the transportation of arms and explosives, photographic apparatus, and wireless telegraphic apparatus shall be forbidden, no doubt for military reasons. All airships must be able to signal audibly and visibly, in order to give warning of their approach. Germany has expressed a desire that definite landmarks should be provided for the aerial navigator. In landing, airship pilots are to avoid military fortifications and camps. The delegates will meet for their last conference in Paris.

The port of Santa Marta is connected with Barranquilla, on the river Magdalena, by means of the Santa Marta Railway to a point on the Ciénaga lagoon, 23 miles from Santa Marta, and thence by river steamboat through inland waterways, a distance of 61 miles, the water transit occupying about nine hours. According to a consular report, the excavation of a canal, which is being carried out by the Santa Marta Railway Company, and shortly to be opened to traffic, will cut off seven miles of a difficult portion of the route and shorten the trip by nearly two hours.

The appearance of Messrs. J. Armstrong Drexel and John B. Moissant at the International Aviation Tournament at Belmont Park, October 22nd to October 30th, is now certain. More than fifty per cent of the boxes have already been sold. The demand for parking space is just as great.

THE FINGER-PRINT SYSTEM OF IDENTIFICATION

BY HAROLD J. SHEPSTONE

From time to time many systems have been put forward by the police authorities for use in affording a ready and a reliable method of identifying criminals. So far back as 1882, the penal service of France adopted M. Bertillon's measurement system. For years the British police were content with registering a full description of habitual offenders against the law, with the distinctive marks on their bodies, these signs being classified under nine main divisions.

Then, in July, 1901, the system of identification by finger prints was adopted by the Metropolitan Police of London, and experience has undoubtedly shown that it is at once a simple and reliable means of identifying a person. Since that date the Convict Supervision Department of New Scotland Yard, London, has made upward of 54,000 identifications, and, so far as is known, without an error. All classes of evil-doers have been brought to book by the impressions of their fingers which they have left behind them on the scene of their crime.

The wonderful lineations, in the form of ridges and patterns, which adorn the palmar surface of the human hand, had, of course, been known for many years. Mr. Francis Galton, the famous traveler and scientist, was perhaps the first to give serious attention to the subject of finger prints. He discovered many interesting facts about them. Then, in 1823, Prof. Purkenje, of Breslau, read a paper before the University of Breslau on the subject. Up to this date, however, no practical use could be made of the impressions for the want of a system of classification. Prof. Purkenje certainly suggested one, but little notice appears to have been taken of it.

Naturally, to be of any value to the police or to any government department, it was absolutely essential to classify the prints in such a way that they could be

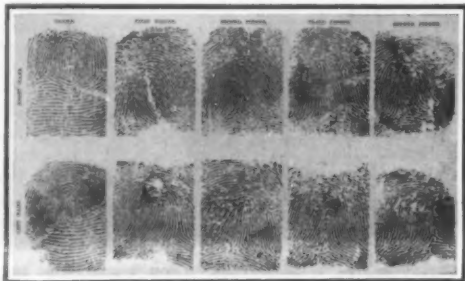
Then it is only fair to add that Sir Edward R. Henry, the Commissioner of the Metropolitan Police of London, has also devoted much time and study to the subject.

His book, "Classification and Uses of Finger Prints," has passed through many editions, and has been translated into several foreign languages. Indeed, I am indebted to Sir Henry for assistance in the preparation of this article, particularly in the loan of the illustrations.

One of the most interesting facts about this system is that every member of the human race, irrespective of age or sex, carries in person certain delicate markings by which identity can be readily established. If the inner surface of the hand be examined, a number of very fine ridges will be seen running in definite directions, and arranged in patterns, there being four primary types—arches, loops, whorls, and composites. It has been demonstrated that these patterns persist in all their details throughout the whole period of human life. The impressions of the fingers of a new-born infant are distinctly traceable on the fingers of the same person in old age. The fact that these patterns persist on the bulbs of the fingers are characteristic of and differentiate one individual from another, makes it an ideal means of fixing identity. I have inspected portraits of different men at the London police headquarters at New Scotland Yard so much alike that it is virtually impossible to tell one from the other

so far as facial characteristics are concerned. Yet their finger impressions, which I examined, were entirely different.

The system was first used by the police in the Province of Bengal, India, at the instigation of Sir William Herschel. Its value was at once apparent. The



Finger impressions of an orang-outang (anthropoid ape) taken at the London Zoo. They were made by Scotland Yard.



Cash-box in bedroom of murdered man and wife. The thumb impression (pointed at by arrow) led to arrest of the murderer.



Candle bearing thumb mark of a burglar.



On the spike of the gate (indicated by an arrow) a criminal left his finger and ring, which led to his conviction.



Palmary impressions of whole hand, showing how it is covered with ridges and patterns.

readily referred to and identity established without undue delay. It was virtually left to Sir William Herschel, of the Indian Civil Service, to invent a really practical system of classification, so it may be claimed that the finger-print method of identification, as at present adopted, is the discovery of an Englishman.



Arch: In this pattern, ridges run from one side to another, making no backward turn.



Loop: Some ridges in this pattern make a backward turn but without twist.



Whorl: Ridges here make a turn through at least one complete circuit.



Composite: Includes patterns in which two or more of the other types are combined.

IDENTIFICATION OF CRIMINALS BY FINGER PRINTS.

work of the courts was considerably lightened, as the natives recognized that a system of identification had been discovered which was indisputable. Then from the police it was introduced into various branches of the public service, and here again its value was quickly demonstrated. When native pensioners died, for instance, friends or relatives personated them, and so continued to draw their allowances. By recording the identity of pensioners by finger prints, this evil was quickly stamped out.

Indnumerable illustrations could be given of how the perpetrators of crime have been identified and convicted by their finger prints. Impressions left by criminals on such articles as plated goods, window panes, drinking glasses, painted wood, bottles, cash boxes, candles, etc., have often successfully supplied the clue which has led to the apprehension of the thief or thieves. One of our illustrations is that of a champagne bottle which was found empty on the dining room table of a house which had been entered by a burglar in Birmingham, England. There was a distinct impression of a thumb mark on the bottle, indicated by the arrow. An officer of the Birmingham City Police took the bottle to New Scotland Yard, London, and within a few minutes a duplicate print was found in the records. The burglar was arrested the same evening.

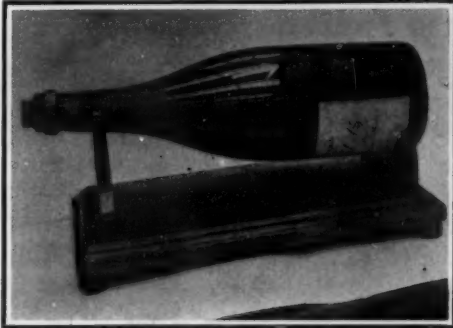
Many similar instances could be given of how thieves have been caught by handling bottles and glasses. On one occasion a burglar entered a house in a London West End square, and before leaving helped himself to a glass of wine. On the tumbler used he left two finger imprints, and these were subsequently found, upon search in the records at New Scotland Yard, to be identical with two impressions of a notorious criminal who was in due course arrested and sentenced to four years' imprisonment.

A somewhat gruesome relic is the cashbox which contains the blurred thumb mark of a man who was convicted of murder. The box was found in the bedroom of a man and his wife who were murdered at Deptford, London, in 1905. The cashbox was taken to New Scotland Yard, and the impression photographed and enlarged. Two brothers, suspected of the crime, were arrested, and the thumb print of one was found to be identical with that on the lid of the box. Our photograph of a gate recalls a curious case that recently occupied the attention of a London magistrate. In this instance a thief successfully climbed the gate, which was ten feet high. In his attempt to reach the ground on the inner side he placed his feet on the center cross-bar, at the same time holding the spikes with his right hand. In this position he fell, and the ring he wore on his little finger caught on the spike indicated by the arrowhead. This caused him to remain suspended in the air until his weight tore the finger from his hand. The ring with the finger was found on the spike, and in due course was received at New Scotland Yard. An impression was taken of the finger, and search among the records revealed a duplicate print, which led to the man's arrest.

If a criminal handles a piece of candle or removes a pane of glass and leaves these behind, it is a hundred to one he has left a valuable clue for the police. The candle shown bears the imprint of a man's thumb, and was found in a house which a burglar had entered. By handling the candle, the thief virtually signed the warrant for his own arrest.

As already stated, the

impressions are divided up into four distinct types or patterns. First, we have arches in which the ridges run from one side to the other, making no backward turn. In loops, however, some of the ridges do make a backward turn, but are devoid of twists. In whorls some of the ridges make a turn through at least one complete circuit. Under composites are included patterns in which two or more of the former types are combined



A champagne bottle having thumb imprint, which led to arrest of a burglar.

in the same imprint. Although similarity in type is of frequent occurrence, completely coincident ridge characteristics have never been found in any two impressions. It is not necessary here to enter into a detailed account as to how the classification of these wonderful lineations of the human hand is effected. It is based on a number value, attained by an examination, by means of a magnifying glass, of the "deltas" and "cores," which break up a collection into as many as 1,024 separate primary groups, each of which can again, by a system of sub-classification, be further split

up into quite a number of sub-groups. When the British police discover finger prints on articles at the scene of crime, the latter are at once conveyed to New Scotland Yard. If the impressions are very faint, a little powder, known to chemists as "gray powder" (mercury and chalk), is sprinkled over the marking and then gently brushed off with a camel-hair brush. This brings out the imprint much more clearly. If one places his dry thumb upon a piece of white paper no visible impression is left. If powder, however, is sprinkled over the spot and then brushed off, a distinct impression is seen. In the case of candles and articles of this nature, a drop of printer's ink is lightly smeared over an impression, in order the more clearly to define the ridges and patterns.

At the headquarters of the British police at New Scotland Yard they possess special cameras and a dark room for photographing these thumb marks. The dark room is 21 feet long and 7 feet wide. When finger prints are required for production in court they are first enlarged five diameters with an enlarging camera. The negatives are afterward placed in an electric light enlarging lantern, with which it is possible to obtain photographic enlargements of a thumb mark 36 inches square. The lantern is arranged on a specially made table 12 feet long, the lantern running between tram lines, so that when moved it is square with the easel.

Criminals have naturally come to dread the value of their thumb marks as a means of identifying their movements. Some will try to obliterate the markings by pricking their fingers, but so far this has not availed them. To successfully accomplish this it would be necessary to obliterate the whole of the palmary impressions on the tip of each finger of each hand.

Then the system too is far in advance of any other, both in reliability and simplicity of working. Compared to anthropometry, for instance, invented by M. Bertillon, in which measurements of certain portions of the body are relied upon as a medium of identification, the finger-print system is certainly preferable.

In the first place, the instruments are costly and are liable to get out of order; while the measurements can only be taken by a fairly educated person, and then only after a special course of instruction. In the finger-print system the accessories needed are a piece of paper and ink, while any person, whether educated or not, after half an hour's practice, can take legible finger prints. Then the classification of the latter is much simpler and readier of access than the former.

At the time of writing there are some 164,000 finger-print records in the pigeon-holes at New Scotland Yard, and the number now being added to it is at the rate of about 250 weekly. The system too is not only in use in Great Britain, but in all the provinces of India, including Burma, and in most of the British colonies and dependencies. It is being rapidly extended, not only throughout Europe, but also through North and South America.

A new car yard is being built by the Pennsylvania Railway to eliminate congestion on its tracks between Broad Street and West Philadelphia. It is situated between Twentieth and Twenty-third Streets, Philadelphia, and will accommodate 60 cars, or about nine suburban trains. One hundred and five brick buildings are to be demolished to make room for this yard. Two new bridges are to be constructed over the Schuylkill River, giving room for four main-line tracks between West Philadelphia and the Twenty-third Street plant.

SPECIMEN FORM.									
This Form is not to be pinned.									
H.O.R. No. _____					MALE				
Name _____					Classification No. 28. MM.				
Aliases _____					32. II.				
RIGHT HAND.									
1.—Right Thumb.	2.—R. Fore Finger.	3.—R. Middle Finger.	4.—R. Ring Finger.	5.—R. Little Finger.					
(Fold.)				(Fold.)					
Impressions to be so taken that the flexure of the last joint shall be immediately above the black line marked (Fold). If the impression of any digit be defective a second print may be taken in the vacant space above it.									
When a finger is missing or so injured that the impression cannot be obtained, or is deformed and yields a bad print, the fact should be noted under Remarks.									
LEFT HAND.									
6.—L. Thumb.	7.—L. Fore Finger.	8.—L. Middle Finger.	9.—L. Ring Finger.	10.—L. Little Finger.					
(Fold.)				(Fold.)					
LEFT HAND.					RIGHT HAND.				
Plain impressions of the four fingers taken simultaneously.					Plain impressions of the four fingers taken simultaneously.				
Impressions taken by _____					Rank _____ Police Force _____				
Classified at H.C. Registry by _____					Date _____				
Tested at H.C. Registry by _____					Date _____				
12345					P.T.O.				

Specimen finger-print record.

IDENTIFICATION OF CRIMINALS BY FINGER PRINTS.

THE HEAVENS IN OCTOBER

BY HENRY NORRIS RUSSELL, PH.D.



It is not always among the brightest constellations that the most interesting objects are found. A good example of this is furnished by Cepheus, the group whose outline is shown in our initial letter.

The legendary monarch here commemorated, plays, like his wife Cassiopeia, but a subordinate part in the thrilling story of the rescue of his daughter Andromeda; and, appropriately enough, the constellation which bears his name, though ancient in origin, has no conspicuous stars. It is not difficult, though, to identify it as a zigzag line of stars of the third and fourth magnitudes, west of the somewhat similar, but smaller and brighter group of Cassiopeia, and now in the northern sky, high above the Pole, in the early evening.

Its three brightest stars gain a certain interest when it is known that, as the celestial pole in its slow but steady precessional motion moves away from the present Pole-star, they will one after another take its place as the "North Star" of millenniums to come; γ Cephei having this position about 4500 A. D., β Cephei succeeding to it some 1500 years later, and α Cephei playing its part in the same role for several centuries following the year 7500. Only the last, however, will be as near the true pole as our present Pole-star is now.

It is of more immediate interest to note that Beta Cephei is a fine double—the components, of the third and eighth magnitudes, being apparently fixed in relative positions, at a distance of 13½ seconds of arc, so far as the observations of the last ninety years show.

As, however, the fainter star shares the very slow motion of the primary, relative to the neighboring stars, it is very probable that the two are really of common origin, and are in slow motion—so slow that it may take centuries of observation to reveal it—in a vast orbit whose complete circuit must occupy tens or even hundreds of thousands of years.

In remarkable contrast to this is the fact, brought out by spectroscopic observation, that the principal star is a very close binary in exceedingly rapid revolution, a complete circuit of the orbit taking less than five hours, which is the most rapid orbital revolution so far known.

A couple of other double stars deserve notice. Xi Cephei, which lies midway between α and ϵ , is a fine pair, the yellow primary of the fifth magnitude and the blue companion of magnitude 6½, being 7 seconds apart. Kappa Cephei, which lies about midway between β Cephei and ϵ Ursae Minoris (the second star in the tail of the Little Bear, counting from Polaris) is also a fine double of about the same separation, with the primary greenish white, and the eighth magnitude companion blue.

All three of these pairs are separable in a small telescope; but to separate the close pair, which the spectroscope reveals in β Cephei would probably require an instrument several hundred feet in diameter.

The naked-eye observer may find in this same constellation an object of great interest—the variable star Delta Cephei, which lies about 3 deg. from ζ Cephei (shown on the map) in the direction of Cassiopeia. This star is a typical example of a certain class of variables of short period, which are now often called the Cepheid variables on this account. Its changes in brightness are perfectly regular, and it is an accurate time-keeper, successive maxima following one another at intervals of 5 days 8 hours 47 minutes 39 seconds;

but, unlike Algol and the similar stars, its light changes are continuous, without any period when the brightness is constant, the rise being considerably more rapid than the fall.

This star, and all the similar ones which have been investigated spectroscopically, are found to be binary systems whose period is identical with that of the light variation. But in these cases the changes cannot be due to an eclipse of one star of the system by the other, as is the case with Algol; for it seems to be an invariable rule that the star appears brightest just when the principal component is approaching us most rapidly; that is, when the companion would appear almost at its farthest to one side or the other of the principal star; while when an eclipse might take place (provided that the relative orbit was so inclined that eclipses were possible) nothing in particular happens.

This remarkable behavior is one of the most puzzling of the outstanding problems of astrophysics.

ornament of the southern sky, though southern observers may see below it the figure of Grus, the Crane. Aquarius and Capricornus are higher up, and Sagittarius is setting in the southwest. Cygnus, Lyra, and Aquila form a splendid group to the west of the zenith. Eta Aquilae—about two-fifths of the way from θ toward δ —is another interesting "Cepheid" variable, changing from magnitude 3.5 to 4.7 and back again, within a period of 7 days 4 hours 12 minutes.

Ophiuchus is setting in the west, and Hercules and Corona are following Boötes. The Great Dipper lies low in the north, and Draco and Ursa Minor are on the left of the Pole.

THE PLANETS.

Mercury is morning star all the month, but is best visible near his elongation on the 11th, when he rises about 4:40 A. M., and should be visible before daybreak. Venus is close by, rising 25 minutes later, and Mars is not far away, but being fainter and not rising before 5:40 A. M., is practically invisible.

Mercury and Venus are in conjunction on the morning of the 3rd, being about 2 deg. apart.

On the 28th a much more remarkable state of things occurs: Mercury, Venus, Mars, and Jupiter being all within a region 3 deg. in diameter. Venus and Jupiter, which are the last to rise, are less than one-quarter of a degree apart, while Mercury and Mars are about 1 deg. distance from one another, and 2½ deg. from the other pair; but unfortunately they rise only a little more than half an hour before the sun, so that this very interesting conjunction will be difficult to observe.

Jupiter is evening star before his conjunction with the sun on the 18th, but is too near the latter all through the month to be well seen. Saturn is in quite the opposite quarter of the heavens, in the southern part of Aries, and is observable all night long.

Uranus and Neptune are about 90 deg. west and east of Saturn, and are almost opposite one another in the heavens, the first in Sagittarius, the other in Gemini. On the 15th both are in quadrature with the sun on opposite sides; Uranus coming to the meridian at 6 P. M., and Neptune at 6 A. M.

THE MOON.

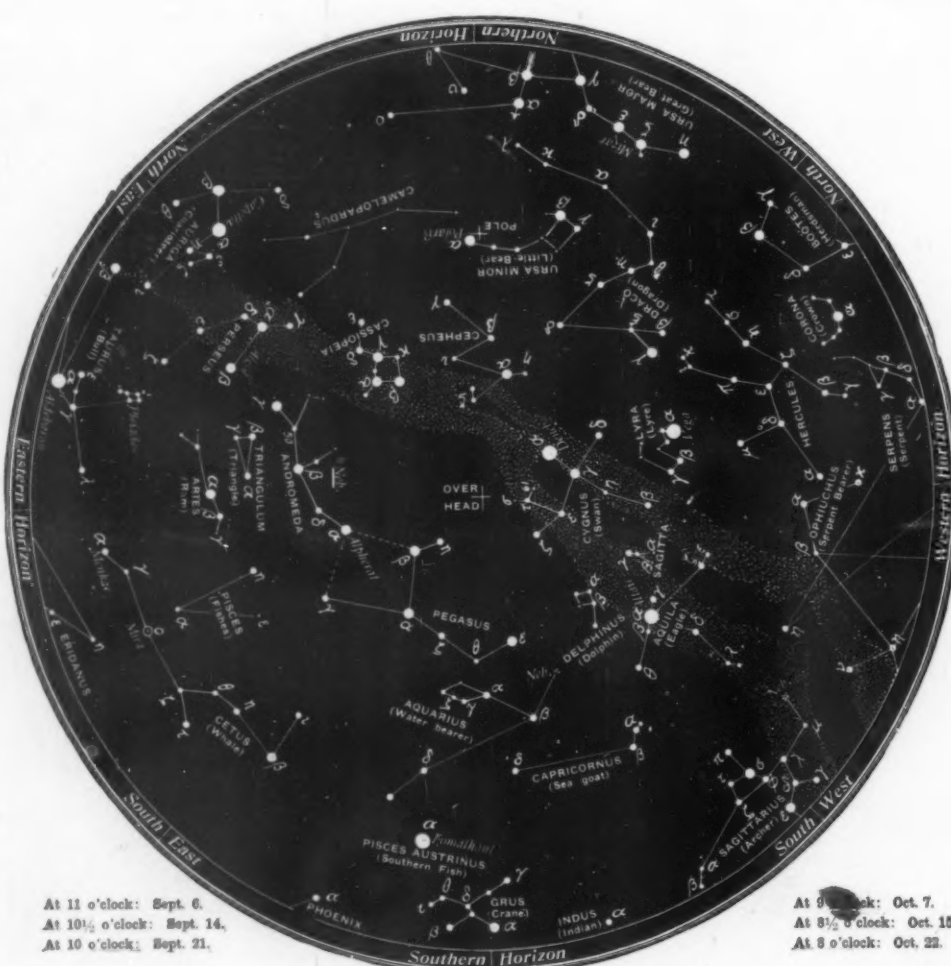
The moon is new at 3 A. M. on the 3rd, in her first quarter at 9 A. M. on the 11th, full at 9 A. M. on the 18th, and in her last quarter at 1 A. M. on the 25th. She is nearest us on the 19th, and farthest away on the 7th. In her circuit of the skies she passes Venus and Mercury on the 1st, Mars on the 2nd, Jupiter on the 4th, Uranus on the 11th, Saturn on the 19th, Neptune on the 24th, and Mars, Jupiter, Mercury, and Venus again within twelve hours, on the night of the 31st and morning of November 1st.

RECENT COMETS.

Metcalf's comet, whose discovery was announced last month, appears, according to the latest elements, to be already past perihelion, and receding from both earth and sun. Its minimum distance from the sun, reached on August 30th, was 180 million miles, and it is now (October 1st) 195 million miles from the latter, and 270 million from us, and is steadily growing fainter. It must be a large comet, intrinsically, to be seen at all at so great a distance.

D'Arrest's comet—a well-known member of our system, with a period of six and two-third years—was picked up by Gounessat at Algiers on August 26th. As it is of the fourteenth magnitude, and is far south in Sagittarius, it can be seen only in the very largest telescopes.

Princeton University Observatory.



At 11 o'clock: Sept. 6.
At 10½ o'clock: Sept. 14.
At 10 o'clock: Sept. 21.

At 9½ o'clock: September 29.

At 9 o'clock: Oct. 7.
At 8½ o'clock: Oct. 15.
At 8 o'clock: Oct. 22.

NIGHT SKY: SEPTEMBER AND OCTOBER

Various theories have been advanced to explain it; for example, that the star is moving in a resisting medium, whose friction heats up the advancing side of the body, making it brighter than the other; but all hypotheses that have so far been proposed are encumbered with grave difficulties.

Puzzling as the phenomena are to theoretical investigators, anyone can observe them with ease. Delta Cephei is easily visible to the naked eye at all times—its variation being from magnitude 3.7 to 4.9—and, as it is three times as bright at maximum as at minimum, its changes are conspicuous. A few nights watching will show the variability.

Before leaving this constellation it may be remarked that μ Cephei (between ζ and α and south of the line joining them) is irregularly variable, besides being one of the reddest stars in the sky.

THE HEAVENS.

Turning to our map, we find Cassiopeia to the east of Cepheus, Perseus below her in the northeast, and Auriga just risen, still farther down. The Pleiades are visible farther to the right, and Aldebaran is rising. Aries and Triangulum are above, and still higher is Andromeda. Cetus fills a great area in the south-eastern sky, with Pisces above, and Pegasus higher still. The bright star Fomalhaut is the principal

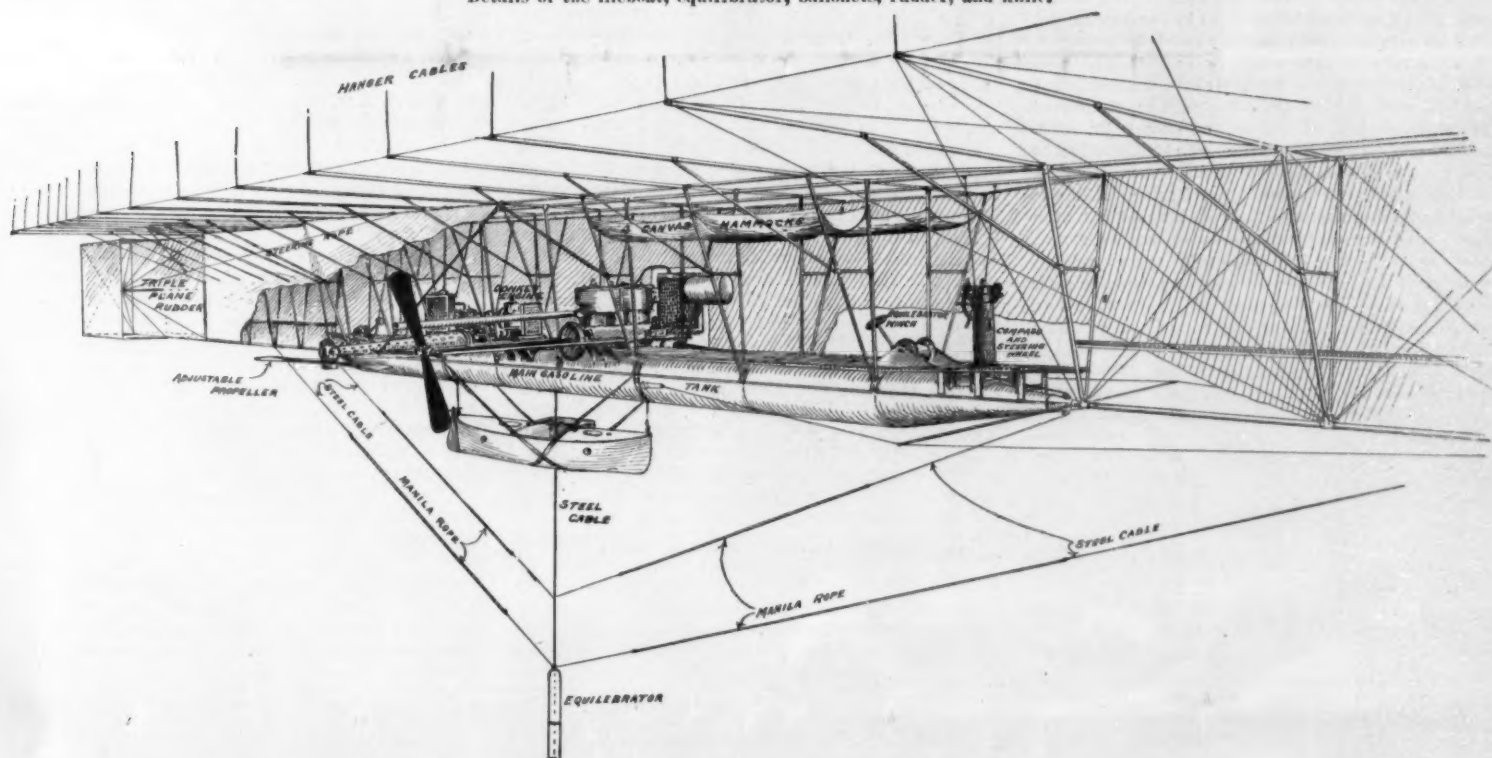
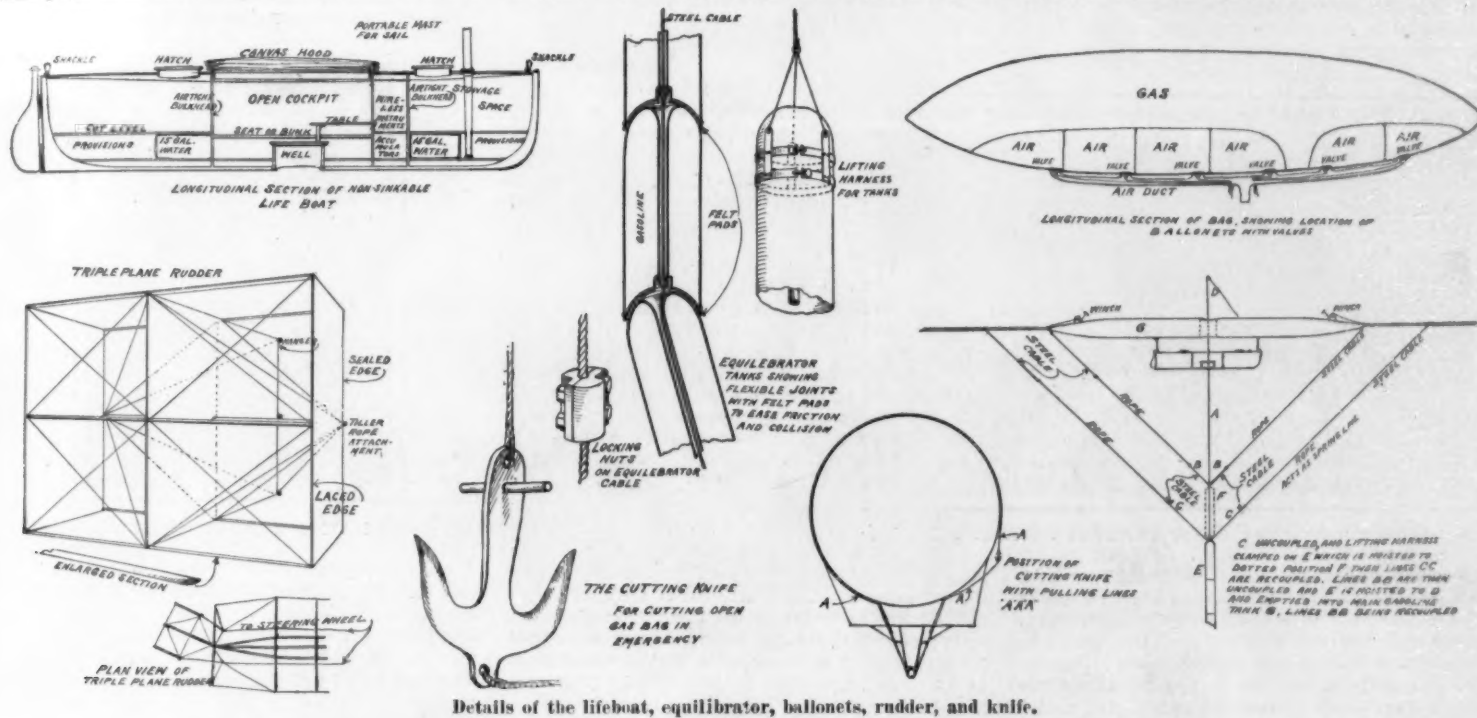
PROPOSED TRANSATLANTIC AIRSHIP FLIGHT

AIRSHIP IN WHICH CREW OF SIX WILL MAKE THE ATTEMPT

In the early days of the dirigible balloon, before any airship had made even 100 miles on a single uninterrupted voyage, Mr. Walter Wellman planned an aerial expedition from Spitzbergen over the frozen Arctic to the North Pole and return, a distance of 1,400 miles. So far were the plans carried out, that a huge dirigible balloon was actually constructed and two starts were made. Now that the glory of discovering the North Pole has been lost to him, Mr. Wellman proposes another daring venture, namely, a trip

never made more than 80 miles, that being on his start for the Pole last fall, when after two hours of sailing, his drag rope, which was a serpentine leather casing filled with food, parted and fell into the sea, leaving the expedition practically destitute of supplies, and with no means of maintaining the balloon at a uniform and safe altitude above the sea and ice. The very fact that so unexpected an accident occurred shows the impossibility of guarding against every eventuality, and emphasizes the necessity of making thorough

The airship is not the same as the one with which the polar expeditions were undertaken. The balloon has been extended to an over-all length of 223 feet, while its diameter is 52 feet, giving a lifting capacity of nearly 12 tons, or to be more exact, 23,550 pounds. The envelope itself weighs over two tons, and is made up of two layers of silk and one layer of cotton gummed together with rubber, so that leakage of hydrogen gas is reduced to a minimum. Unlike the Zeppelin type, the balloon itself is flexible, but the air-



Car of airship, showing positions of engines and support of the equilibrator.

PROPOSED TRANSATLANTIC AIRSHIP FLIGHT.

by airship across the Atlantic Ocean. The start will be made from Atlantic City, and the very shortest distance across is close to 3,000 miles, whereas no airship has as yet made a record of as much as 500 miles of uninterrupted travel, and even the record of a drifting balloon is much less than half that proposed by the Wellman expedition.

Mr. Wellman was greatly criticised when he undertook his Arctic voyage for not thoroughly testing his equipment in inhabited parts before making his venture, to which criticisms he gave the reply that his equipment was designed for Arctic voyages only, and tests under any other conditions would be practically valueless and a waste of time. The same criticism is being directed against him now. His airship has

tests of an equipment in actual practice before starting on a hazardous venture.

It is the plan at present writing to undertake the trip across the ocean with practically no preliminary trial trips, and the chief reason given for such an incautious procedure is that the airship is not adapted for travel over land, but only for ocean travel, and that protracted experiments are expensive. Whatever opinions one may form of the practicability or impracticability of such an expedition, one cannot but be impressed by the splendid equipment of the expedition. Mr. Vaniman, who is the chief engineer, is an experienced builder of airships and aeroplanes, and he has devoted a great amount of thought and study to the different phases of the undertaking.

ship is rendered rigid by attachment to a long car made up of steel tubing in the form of a truss of triangular cross section. This car has been entirely rebuilt, and now measures 156 feet in length. The bottom chord of the structure is a steel tank 75 feet long, which is used for storage of gasoline.

At the top of the truss are a series of transverse brackets. The gas bag is attached to the car by means of rope connection between the ends of these brackets and a band or web formed on the envelope. From the gasoline tank fore and aft, the bottom chord of the truss consists of tubular extensions. To stiffen the gasoline tank laterally, stays are run from the end of the extensions to horizontal cross pieces at the end

(Continued on page 264.)



[The Editor of the Home Laboratory will be glad to receive any suggestions for this department and will pay for them, promptly, if available.]

CONSTRUCTION OF 16-INCH REFLECTING TELESCOPE. BY JOHN E. MELLISH.

After having used an 8½-inch reflector for a year, my interest in the faint nebulae led me to want a larger instrument. The cost of a glass disk for a 16-



HOME-BUILT 16-INCH REFLECTING TELESCOPE MOUNTED OUTDOORS.

inch speculum was even more than I could pay, so I wrote to a friend, who got me two 16-inch disks of polished plate glass. One was only ¼ inch thick. This was used for the tool to grind the other on. The disk of which the speculum was made was 1½ inches thick. The grinding was done with carborundum. The curve was ground to a focus of 98 inches. The motion usually used in grinding a speculum by hand would not do, as the strokes would wear the glass down too much, and there was no glass to spare, so a circular stroke was used throughout, moving the speculum round and round the tool. The tool was fastened on the top of a bench, and the speculum worked over it by hand. The center of the speculum was kept about two inches inside the edge of the tool, thus using a circular stroke with a diameter of 12 inches. The circular stroke was not even. If it had been, the curve would not have turned out so true; one stroke must not equal another,

but must vary a little, so as to keep the glass from wearing in rings. The circular stroke was used only in grinding; the polishing was done with a straight 5-inch stroke.

When the speculum was done, fine grinding and all, the edge of the speculum and the center of the tool had not been reduced

The fine grinding was done using the roughing-out carborundum, graded in water into six grades, the finest being sixty minute. This left the surface in a splendid finish. Great care had been used to leave no points on the surface that each grade could not take out. The rough grinding took two and a half hours, the fine grinding

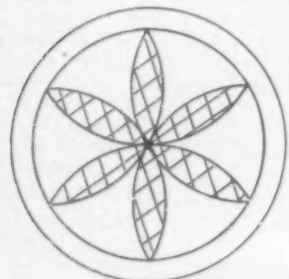


Fig. 1.—SIX-LEAVED POLISHER. In thickness at all.

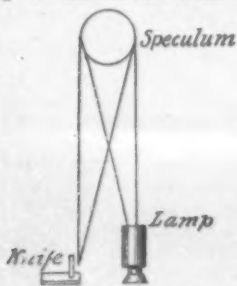


Fig. 2.—FOUCAULT TEST OF THE LENS.

three and a half hours, and the polishing five hours. The polish came on perfectly even all over the surface. Soft pitch was used, and new facets had to be made every hour. The glass was not tested until it was polished; then the curve was found to be very close to the sphere, the focus of the edge being ¼ inch longer than the central parts; but the curve was uneven. Special shaped polishers were used for a few minutes at a time for several days when the curve was brought to the sphere, with not a sign of irregularity or of flexure.

The first polisher used had a diameter of 15½ inches; this brought a fine surface clear to the edge. A six-leaved polisher was used for bringing the sphere to the true parabolic curve. The polisher is shown in Fig. 1.

The polisher was made of a coat of pitch on top of the glass tool. The pitch was of a fine quality, known as Burgundy pitch, four pounds being used, making a pad nearly ½ inch thick. The pitch was covered with a thin coat of beeswax, which puts a finer surface on the glass than pitch does.

The diameter of this polisher was only 14 inches. The speculum was moved over it, using straight strokes five inches long, and at the same time swinging the speculum to each side three inches. This brought the surface to a true, even parabola.

The focus of the center was 0.34 of an inch shorter than the focus of the edge. The Foucault shadow test and the zonal test were used; and by taking several readings, the curve could be read off to 0.01 of an inch or very near.

The Foucault shadow test was conducted as follows: An oil lamp with a tin chimney, and a small needle hole in front of the blaze, served as an artificial star. The speculum was placed just twice the focal length away, and a knife blade was mounted in a block, as in Fig. 2. The light from the artificial star was thrown back from the speculum to the knife. The knife was mounted always to the left of the lamp, and the cone of rays were always cut with the knife moving from left to right.

When the knife cut the rays, the surface darkened in places, showing what appeared to be hills and hollows. The hills were worn away with special polishers of various shapes.

The plane mirror used is common plate glass, one inch thick, and the telescope shows the diffraction rings to a star out of focus, and with the eyepiece each side of the focus. The rings are exactly alike both sides of the focus, using a power of 550 diameters. The telescope has divided double stars to 0.3 second, and stars as faint as 14.6 magnitude have been seen.

When the aperture is cut down to 12 inches, the stars are not bettered, but are not nearly so bright, thus showing the edge to be correct.

The central disk is easily seen, to the brightest stars. There is no haze, but a lot of floating specks of light, mostly owing to unsteady air.

The speculum is set in a wooden cell with a pile of paper rings at the back, and some steel springs to hold it in place. There is a piece of thick rubber between the steel springs and the glass.

The photograph of myself and the 16-inch telescope was taken last January, when the snow was three feet deep. The snow was piled up to get at the telescope, which stands outdoors all the time. The glasses and the ends of the tube are covered with caps when not in use.

The whole 16-inch telescope thus far has cost only \$17, but the tube and mounting are very poor, and some new parts are started on now.

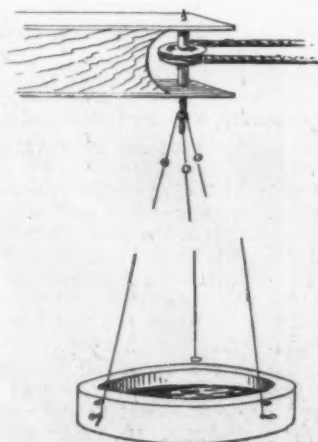
This telescope is as good as a 14-inch refractor for light-gathering power, and far better on the planets, for the reason that a refractor shows a blue light around bright objects, while the reflector shows none.

SUSPENDED ROTATING LIQUID MIRRORS FOR TELESCOPES.

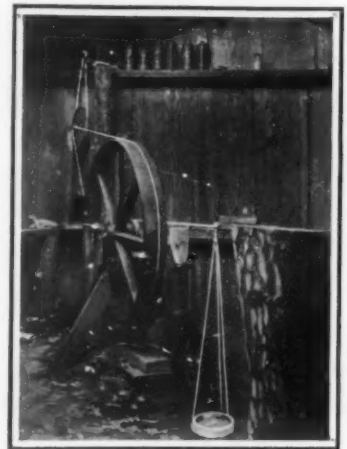
BY CLIFTON R. SUMMERS.

A little more than four months ago I finished a suspended rotary mercury mirror, which has been tested in various ways pretty thoroughly, and a description of which might interest many readers of the SCIENTIFIC AMERICAN.

To the top of a post is fastened one end of a wooden beam, at the other end of which are fastened two strips of brass, one above the other, having holes at their outer ends through which the ends of a short vertical shaft are passed. The short vertical shaft has a small grooved pulley at its center, and it is larger between the two strips of brass, making shoulders, the lower of which rests on the lower strip of



CORD ATTACHMENT TO THE DRIVING SHAFT.



ROTATING MERCURY REFLECTOR.

brass, carrying the weight of the suspended dish of mercury. The mercury dish is suspended from the lower end of the vertical shaft by three wires, each wire about twenty-two inches long and having at each end a short length of cord. The wires not being liable to stretch, hold the mercury dish in proper adjustment, while the short length of cord gives the necessary flexibility.

The short cords at the upper ends of the wires are fastened to the lower end of the vertical shaft, at equal distances from each other, by winding a thread around them and the shaft into a groove made round the shaft for that purpose. The short cords at the lower ends of the wires pass through small staples and are wound round small brass adjusting screws, let into the outside of rim of the wooden mercury dish, at equal distances from each other.

The wooden mercury dish was made on a lathe of

five-inch swing and could only be about four and a half inches in diameter on the inside. It was turned concave on the inside of the bottom, the center of concavity being about half the distance between the mercury dish and the lower end of the vertical shaft. This was done by placing the center of the handle of a round-nosed chisel (a small hole being bored in the handle for the purpose) against the center of the tail stock, and moving the chisel back and forth along a rest in front of the rotating dish.

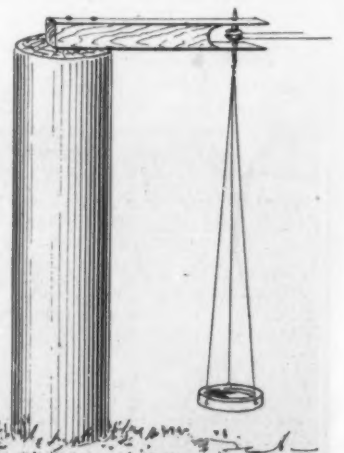
The concavity is necessary so that the mercury will stay in the center, no matter how small an amount the dish contains.

In adjusting the dish, mercury is poured in until it almost covers the bottom, then the adjusting screws are turned to the right or left, until the rim of the dish is parallel with the level of the mercury. When this is done carefully, the dish will hang exactly plumb and will rotate perfectly true; then more mercury should be added.

This machine is intended to be turned by any steady motor giving an exact number of revolutions per minute. A water motor would probably be an ideal motor for this purpose; but the only motor convenient was a small electric motor, which is run by dry batteries, and this is what I have been using.

This motor, being somewhat worn, jars some, and in using it, it was necessary to connect it by a reduction speed pulley to a fifty-pound flywheel, rotating about twice per minute. The flywheel shaft carries a pulley large enough to give the necessary speed to the pulley on the short rotating mirror shaft, to which it is connected by means of a cord belt, as are all of the pulleys.

It is very interesting to watch the effect of the heavy flywheel at different speeds of rotation. At



MOUNTING OF THE MERCURY DISH.

speeds above about two revolutions per minute, the mercury commences to tremble; the faster the fly-wheel turns the more the mercury trembles, while at about two revolutions per minute or less the mercury is almost calm, giving clear images of the stars above and of any object above the focus. The trembling of the mercury is very slight and can only be noticed when the eye is near the focus. The mirror, suspended as described above, gives great flexibility, and when run in connection with the slow-moving flywheel and by the electric motor, gives a focus perfectly steady, as far as we could determine with a reading glass for an eyepiece.

The trembling of the mercury is extremely faint, being in the center of the dish, and does not interfere with the image. The images of the stars are fine.

If this machine was constructed by a skilled machinist, it would probably give as good satisfaction as any parabolic mirror of silvered glass and would also be excellent for casting concave mirrors for telescopes.

I have not had an opportunity to study all of the experiments that have been made on rotating liquid mirrors for telescopes, but I believe the experiments above described are new, and, if carried out on a larger scale, will help to enlarge the usefulness of the telescope.

The suspended rotary liquid telescope could be cheaply constructed by sinking a shaft or by suspending from a hill or bluff, giving any desired length of focus. I hope others will continue these experiments, as they seem so promising.

I wish to thank Prof. R. W. Wood, of Johns Hopkins University, for his description of his mercury telescope in the *SCIENTIFIC AMERICAN* of March 27th, 1909. The article was very instructive to me and I believe if he would mount and connect a slow-moving flywheel of say a ton in weight in the manner explained above to his rotating mirror, he might dispense with his threads of India rubber, make a more rigid connection resulting in a steady focus with probably less trembling of the mercury.

CELESTIAL PHOTOGRAPHY FOR AMATEURS.

BY ALFRED RORDANE.

This article is written in the hope that it may induce some of the astronomical readers of the *SCIENTIFIC AMERICAN* to take up this fascinating branch of astronomy.

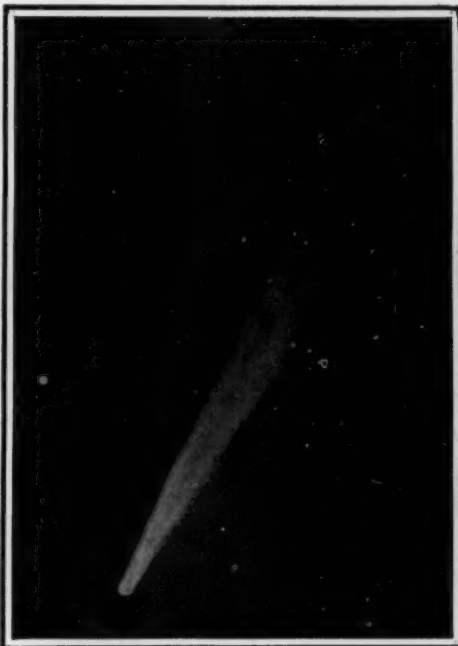
To show that this task is not entirely hopeless for the amateur, I submit the reproductions of various celestial objects, which were photographed without costly instrumental means or clockwork, the guiding being done entirely by hand. For this purpose the amateur needs only a guiding telescope of the size and aperture that may be at hand, on a rough equatorial stand, with one or more cameras attached to the telescope tube.

The amateur astronomer is usually looked upon by his friends and neighbors as a kind of harmless lunatic; and when he is seen busying himself around his telescope, he is usually pestered by an inquisitive individual with questions like the following: "What can you see, Mister?" or "What's the weather going to be to-morrow?" He will have to bear these annoyances with resignation, until he can make some discovery that will give him that prestige which scientific attainment of any kind always impresses on the lay mind. The real scientist, on the other hand, looks upon the amateur in quite another light; witness the following words by Prof. George E. Hale in a lecture delivered at the Royal Astronomical Society, London, June 26th, 1907: "According to my view, the amateur is the man who works in astronomy because he cannot help it, because he would rather do such work than anything in the world, and who therefore cares little for hampering traditions or for difficulties of any kind. The 'amateur,' then, may be connected with a small observatory in the capacity of professional astronomer

or be working by himself with very simple instrumental means."

Photography with ordinary portrait lenses shows more of the real structure of the heavens than can be seen with the giant telescopes, from the fact that the field of view in the telescope is restricted in proportion to its power, and no general view can be had at any one time.

The large field of the portrait lens renders it suitable for seeking and photographing faint nebulosities, for these can be traced only when their borders are followed for a considerable distance against a part of



HALLEY'S COMET, MAY 11th, ENLARGED FROM PHOTO BY THE AUTHOR. LENS, 2-INCH APERTURE, 5-INCH FOCUS. EXPOSURE, 15 MINUTES.

the sky absolutely free from nebulosity. The large nebulae in Cygnus, Taurus, Cassiopeia, Aquila, and many others, could never have been discovered visually or photographically with the telescope. Very short-focus lenses, however, have a tendency to crowd the nebulosities too much and hide the rifts. Another noticeable fault is the want of flatness of the field, resulting in distortion of stellar images outside the center of the photographs.

The stand illustrated herewith is constructed for a Newtonian reflector; but the same idea may be carried out, suitable for a refractor. The reflector I consider the best for the amateur's need, as it is so much more convenient, and size for size, cheaper.

THE EQUATORIAL STAND.

As will be noticed, the equatorial stand is of extremely rude and simple construction, yet strong enough to support a number of cameras as well as the telescope, without shaking, being made of gas pipe, which is easily procurable in any lengths desired. The construction can be easily seen from the photograph, and consists of the polar axis *A*, which turns in the stationary pipe *B*, resting on the ground, to which are fastened the upright pieces *C C*. To the polar axis is fastened the block *D*, through which the declination axis *E* turns, and to the end of which the counterpoise *F* just balances the weight of the telescope. By adding to the weight of the counterpoise we can balance any number of cameras we may desire to use. Clamping of polar and declination axis is done by means of screws *G* and *H* respectively. Driving in

done by the handle *I*, which actuates the tangent screw *J* through the universal joint *K*. Lately I have discarded this arrangement, instead guiding the telescope and camera in right ascension by taking hold of declination axis, and moving it by hand, the declination axis being clamped at all times. I need hardly say that the polar axis must be pointed at the pole of the heavens as accurately as possible. The seat of the observer must be as comfortable as possible, as the following of the guiding star is very fatiguing work.

THE CAMERA.

The camera had best be a square box made to the right length, as the focus once found, nothing should be altered, and every lens should have a separate camera. It is no use trying to focus on the stars; the best way is to expose several plates, until the star trails show as the finest lines; but if the amateur has had any experience in photography, a distant mountain or other large object will do well enough. A good way is to compromise on the roundness of the field, and focus sharply at a little distance from the center; this will tend to make it sharpen all over, at the expense of the center. Of course, it is understood that no stops of any kind must be used.

THE GUIDING TELESCOPE.

This should be as powerful as can be had, as sometimes it may be convenient to follow a faint star. The eyepiece should be provided with cross wires, and should magnify at least fifty diameters. The guiding star should be put slightly out of focus, to form a disk, which may then be accurately bisected, and one of the wires put parallel with the motion of the star in the field of view.

THE PLATES AND DEVELOPING.

Sigma Lumière are the fastest commercial plates at present obtainable, and should have a backing applied, or instead, the non-halation brand of the same plate may be used. The exposure may vary to suit the occasion; for the Milky Way, the longer we expose the more stars will be seen on the negative. If the same plate is to be exposed on successive nights, the telescope must be kept with the camera and lens in position, merely being covered to exclude light. Directions for developing will be found in every box of plates, and should be rigidly followed, as the manufacturers know best what developer is suitable for their plates.

THE LENS.

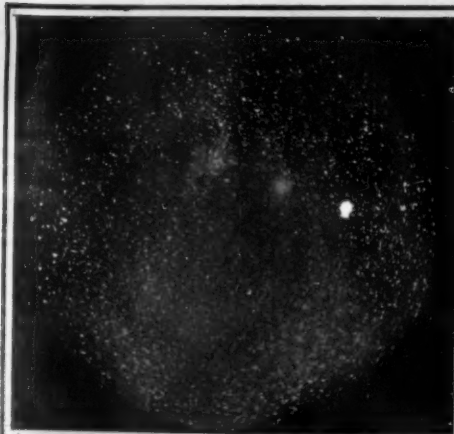
The lenses I have used are ordinary portrait lenses, which are used in photographic studios for quick work. The largest I have is a Darlot combination of 3-inch aperture and about 10-inch focus. Another, which belonged to a friend, was a very fine Dallmeyer of 2-inch aperture and 5-inch focus. Lenses smaller than these would not be of much use.

PHOTOGRAPHY OF THE MOON.

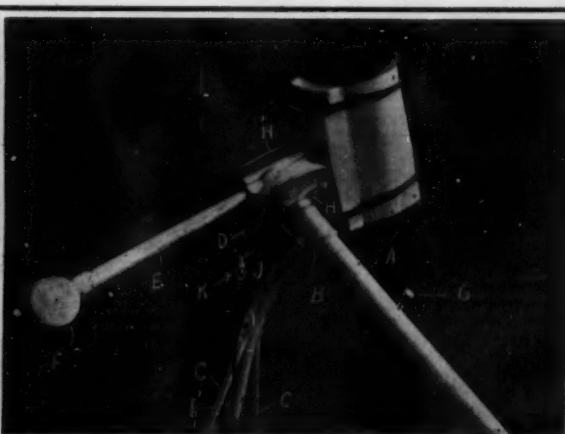
The photograph of the moon reproduced herewith has no particular value, excepting that it shows it is possible to make astronomical pictures with a 6½-inch reflector. The visual and photographic focus being identical in a reflecting telescope, simplifies the problem. The picture was made on a Seed 27X plate with an exposure of about one-fifth of a second, being made in the primary focus of the telescope, the image of the moon being about ⅝ of an inch in diameter. Better results might perhaps have been secured by interposing a Barlow (negative) lens.

PHOTOGRAPHY OF COMETS.

Photographing comets is rather difficult from the fact that they are generally more or less close to the dawn, or else the evening twilight, and thus require good judgment as to the time of exposure, which if too short will fail to impress the plate, and if too long will produce fog. In the case of large comets, a short focus lens is useful in taking the full extent of the tail, and of course the nucleus must be used for guiding and not the stars.



STAR CLOUD IN CASSIOPEIA PHOTOGRAPHED BY THE AUTHOR WITH A 3-INCH LENS.



EQUATORIAL MOUNTING FOR THE CAMERA.



PHOTOGRAPH OF MOON WITH 6½-INCH REFLECTOR REVERSED IN ENLARGING.

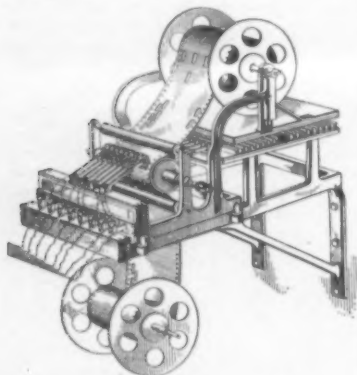
RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

SKIRT-MEASURING DEVICE.—ANNA M. ALLEN, Yuba City, Cal. The invention relates to skirt measuring devices, and has for its object to provide a device which will permit the dressmaker to measure a skirt on a person to ascertain the length, without turning it inside out, the measuring device being disposed outside of the skirt, with parallel guides and holders disposed circumferentially around the skirt.

Electrical Devices.

ELECTRICAL SWITCHING DEVICE.—JAMES G. MEREDITH, Lynchburg, Va. In connection with moving-picture apparatus, it is frequently desirable to use instruments for sounding devices, that will produce a more real and life-like impression. To effect such an accompaniment automatically, an instru-

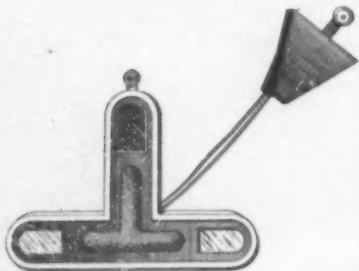


SWITCHING DEVICE FOR MOVING PICTURE EXHIBITIONS.

ment has been devised, comprising a series of electrical switches controlled by a perforated roll. The latter is adapted to be reeled off in synchrony with the moving-picture film. The electrical switches serve to actuate the sounding instruments.

APPARATUS FOR USE IN EXERCISING, AND DEVELOPING AND APPLYING STATIC ELECTRICITY.—M. M. HIRT, Luray, Va. This invention is a simple apparatus adapted for use in exercising the legs and also for simultaneously developing and applying static electricity. In use, one stands in stocking feet with either foot on one side of the apparatus, while the other is swung through the space that intervenes between brushes to generate the static electricity.

INDICATOR.—CHARLES EINSHEIMER, 583 Broadway, New York, N. Y. It is the common custom, and in many localities a legal requirement, for an automobilist, when about to stop, or to make a turn, to signal the fact for the benefit of following vehicles and for his own protection, by raising his hand. At

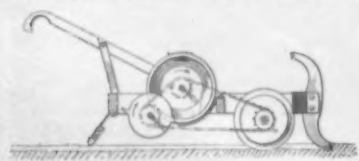


SIGNAL FOR AUTOMOBILES.

night, such signals cannot be seen, and accidents are liable to occur. To overcome such dangers, the illuminated signal here illustrated has been devised. The signal lamps are controlled by a switch, conveniently located. To signal a turn to the right, the red and right-hand white lights are shown, for a left turn, the red and left-hand white lights, and for a sudden stop, the red light alone.

Of Interest to Farmers.

COTTON PLANTER.—THOMAS N. SEAY, 1906 Main Street, Columbia, S. C. The invention consists of a plow-like implement, comprising a frame with a plow or opener at



COTTON PLANTER.

one end and a cover at the other. A driving wheel is mounted directly behind the opener and is geared by means of a chain to a seed reservoir, consisting of two cups

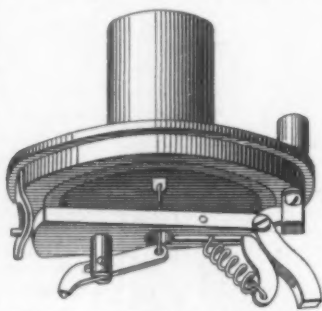
mounted mouth-to-mouth with a narrow space between them, in which a seed-wheel projects. The latter is also geared to the driving wheel and serves to drop the seed at measured intervals into the furrow opened by the plow.

GUARD.—D. D. OGILVIE, Lee, Nevada. In this instance the invention pertains to guards as are employed in certain classes of farming machinery, such, for example, as mowers, reapers, headers, etc., and the aim is to provide a guard construction in which the ledger plates are easily removed and assembled with the guard fingers, and when in operative position, are firmly held.

MOWING MACHINE.—J. P. CROTHWAIT, Georgetown, Ky. This improvement has reference to mowing machines such as are drawn by draft animals, and which comprise a mower bar which is supported normally in a substantially horizontal position near the ground level, and which carries knives or cutters for use in cutting grass or a similar crop.

Of General Interest.

PHONOGRAPH REPRODUCER.—ANTHONY URBAINS, Minden, La. It is frequently desirable to vary the loudness of the sound produced by a phonograph according to the character of the production. For instance, band music or music for dances, or for entertainments in a large hall, should be loud. For



VARIABLE PHONOGRAPH REPRODUCER.

vocal music, however, particularly at home entertainments, softer sounds are much preferable. In order to provide for such variation, Mr. Urbains has invented a jeweled arm, with two notches for engagement with the fulcrum pin, so that the leverage of the arm between the diaphragm and the recorder, may be varied.

FEED-REGULATOR FOR FLOUR-MILLS.—G. H. HOTTEL, Strasburg, Va. This device feeds grain to the rolls of flour mills. An object of the invention is to provide a device in which the feeding of the grain is accomplished by gravity, without the necessity of employing eccentrics, springs, vibrating attachments, with their necessary accompaniment of shafting, pulleys, and belts.

MAIL-BOX PROTECTOR.—E. B. EGLESTON, Sheridan, Ill. This invention is for use especially upon mail boxes designed for rural free delivery routes. An object is to supply means whereby the box may be moved automatically from the position in which mail is introduced into it, by the mail carrier, to a position of safety, so that it is beyond the reach of stock or careless children.

METHOD OF ATTACHING STEEL TO STEEL OR STEEL TO IRON.—G. DAWSON, Crescent, La. The object here is to effect the uniform re-tempering of a saw after the temper has been drawn by the heating of the saw incident to the brazing operation, without reheating of the saw or plunging the same into water, the latter being unsatisfactory, as it is impractical to equalize the temper of the braze with that in the body of the saw in this manner.

KNIFE.—DR. B. T. TRUEBLOOD, 206-7 Marlon Building, Seattle, Wash. Since the advent of the safety razor, the country has been flooded with discarded razor blades that have outlived their usefulness for shaving purposes. Dr. Trueblood proposes to utilize these razor blades for other purposes than



JACK KNIFE EMPLOYING DISCARDED RAZOR BLADES.

shaving, and to this end has invented a holder in which the blades may be securely fastened. The holder may be folded and thus the device takes the place of an ordinary jack knife, with the advantage that the blade is renewable.

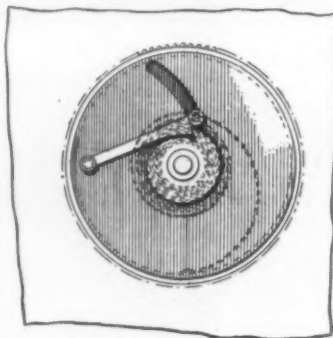
GRIZZLY.—H. A. CORLISS, Grants Pass, Ore. The improvement refers to an ore dressing device of a type which is adapted to separate heavy valuable particles of mineral, such as gold or platinum, from the lighter gangue such as quartz. The device is adapted to be used in any flume, to extract the gold-bearing sands obtained from gold-bearing streams or the like.

PORTABLE FIRE-ESCAPE.—E. P. O'LEARY, Pueblo, Colo. The principal objects of this improvement are: To provide an efficient

means for escaping from a burning building, said means being independently operated; to provide means which are conveniently portable; to provide means which may be operated with safety, without necessitating practice.

DRAWING-BOARD.—G. B. LAMBERT, New York, N. Y. This invention pertains to drawing-boards for use by architectural and other draftsmen, and has reference more particularly to a device comprising a body, and a frame associated with the body and formed to grip and to hold a sheet of paper extending over the body, the frame being operable to stretch the paper, if so desired.

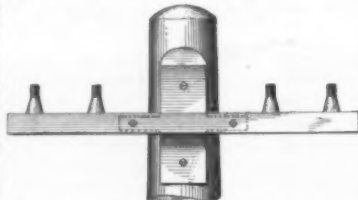
SAFETY WINDING DEVICE.—EDWARD HAWKINS, Nome, Alaska. The attachment pictured in the accompanying drawing is intended to prevent the spring of a watch, clock or the like, from being wound too tightly. It also serves to insure winding of the spring to exactly the same tension each time. On the casing of the spring is an arm provided with a pin, which projects through a slot in the casing and



SAFETY SPRING WINDING DEVICE.

engages one of the coils of the spring. As the spring is wound up, the coils approach each other and the arm is drawn down until the pin reaches the end of the slot, at this point, and to prevent further strain on the spring, a tooth on the arm is brought into engagement with a tooth carried by the winding stem.

COMBINED CROSS-ARM AND BRACE.—JAMES W. McCUNE, New Albany, Miss. The invention is an improvement in cross-arm supports for telegraph and telephone poles, and the like, and is so arranged as to provide an effectual brace between the pole and the



COMBINED CROSS-ARM SUPPORT AND BRACE.

cross-arm, without requiring the use of separate or additional braces. It consists of a cruciform plate, provided with a flange upon which the cross-arm rests. The cross-arm is bolted to the horizontal arms of the plate, while the vertical arms of the plate are bolted to the pole.

HAT HOLDER.—LYDIA A. TYLER, 172 South Lincoln Street, Spokane, Wash. The hat holder here illustrated is designed especially for use

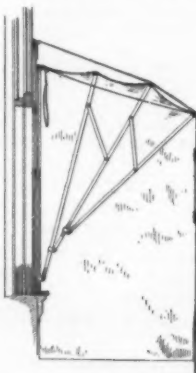


HAT HOLDER FOR MILLINERY STORES, ETC.

in millinery establishments, for supporting women's hats to the best advantage, without danger of tearing or injuring the hat or lining. It comprises a stem fitted with spring arms, each supporting at its upper end a skeleton frame with a segmental clamping member and an extension. The clamping member engages the lining of the hat, while the rim of the hat is supported on the extension.

Household Utilities.

WINDOW TENT.—GEORGE R. SMITH, Arlington, Md. The accompanying illustration shows in section, a folding window tent which may be conveniently applied to an ordinary



FOLDING WINDOW TENT.

bedroom window, and when not in use, may be folded up and removed, so as not to obstruct the light. The tent comprises a folding frame, on which a cloth covering is attached of suitable length to fit over the head of a sleeper, so that he will receive all of the benefits of sleeping outdoors, without exposing his entire body to the sun or unduly chilling the room. A screen in the window serves to shield him from annoying insects.

Hardware and Tools.

ICE-CREAM FREEZER.—C. K. GREAVES, Waco, Texas. This improvement in ice cream freezers has for its purpose the provision of a power freezer, by means of which the cream or the like may be frozen by the use of ammonia, or ice or salt, or both. The parts may be easily removed for cleaning by releasing the rods engaging the head and taking out the head.

THROTTLE-HANDLE FOR PNEUMATIC TOOLS.—W. M. HOLDEN, Barre, Vt. This invention provides an easily operated and inexpensive device, which will automatically cut off the supply of motive fluid when the operator's grip is released thereon, either accidentally or on purpose, so that there is no danger of the tool kicking around and injuring the operator.

Machines and Mechanical Devices.

MAGAZINE.—G. A. SVANBERG, Fort Lee, N. J. Generally stated, the purpose of this invention is to provide a magazine containing a large number of photographic plates adapted to be released one at a time and exposed for the purpose of forming pictures, the mechanism being so arranged that after a predetermined number of plates have been thus used, the magazine, by a slight rotary movement, substitutes another column in place of the one just finished.

MECHANICAL MOVEMENT.—J. W. FITTS, Bisbee, Ariz. This improvement relates to means for the conversion of rotary into reciprocating motion and the reverse, between two mechanical elements, and its aim is to provide details of construction for a mechanical movement, compactly arranged, strong and durable, operate with little friction and a minimum of applied power for useful effect.

STOP AND THROUGH-WAY VALVE.—F. W. LEEVERS, 37 Howard Road, Walthamstow, England. The object of the present invention is to avoid previous difficulties by arranging that the valve disks shall not be thrust upon their seats until they reach the central position and then that they shall be thrust upon their seats simultaneously with a rotational movement so that any wear of the seats resulting therefrom is not detrimental and less force is required to be applied to the spindle to effect a tight closure, than with the wedge type of valve.

CARBURETING APPARATUS.—F. OSTERMAYER, Elizabeth, N. J. The degree of carburization of the air in this mechanism can be regulated independently of the speed of the engine, although the mechanism producing the feed is driven positively from the mechanism of the engine so as to constitute a forced feed. In operation, the liquid fuel is forced through a nozzle having fine perforations so that the fuel is atomized into the air current passing to the engine cylinder.

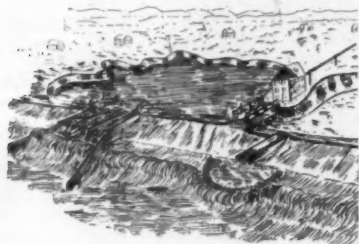
GLASS-BEVELING MACHINE.—E. HOMAN, Jersey City, N. J. Among the objects of this invention are: to provide a machine for holding circular glass disks while a bevel is being ground on the edge; a holder for the disks which is preserved from scratching or clouding; a holder wherein the disk is revolved about a center by the drag of the grinding action; means whereby the revolution of disks about them is regulated and controlled; means for rapidly and easily placing disks in the holding tool; means whereby disks of varying dimensions may be rapidly accommodated; means for adjusting for various bevels; means for inspecting glass cutting without removing

the glass, and means for amplifying the limits of the size of disks.

DUSTING-MACHINE.—U. C. DAVIS, Pittsfield, Mass. This improvement relates to a machine for use in dusting bronzed paper, and the object is to produce a machine which will operate upon the paper without necessitating the use of grippers for advancing the paper in the dusting operation.

Prime Movers and Their Accessories.

HYDRAULIC POWER SYSTEM.—THOMAS A. MACDONALD, 119 Arlington Avenue, Clifton, N. J. The purpose of the system here illustrated is to utilize both the waves and the tides of the ocean for power purposes. The system comprises two reservoirs, one at a



HYDRAULIC POWER SYSTEM.

lower level than the other. The upper reservoir is filled by the ocean at high tide, while the action of the waves upon an inclined chute causes the water to run into a reservoir even when the tide is low. The head of water in the upper reservoir over that in the lower reservoir is used to operate turbines. At low tide, the lower reservoir is emptied by gravity.

INTERNAL-COMBUSTION ENGINE.—L. A. MARTHA, 24 Rue du Champ de Mars, Paris, France. This invention relates to internal combustion motors and has for its object a device for use in charging internal combustion motors and allowing the practical utilization of all liquid hydrocarbons. The device is adapted to be screwed into an opening in the cylinder, and is designed to permit the liquid fuel to be atomized in a medium heated to high temperature, and under considerably reduced pressure in order to obtain complete and rapid vaporization of the fuel.

Railways and Their Accessories.

NUT-LOCK.—M. OMALIA, Scranton, Pa. This invention relates more particularly to the kind of nut locks used in railroad work. Generally speaking it comprises a single member of spring metal, so formed that when subjected to pressure by a nut, the spring member is distorted in three distinct ways, and thereby develops three distinct kinds of torque for holding the nut.

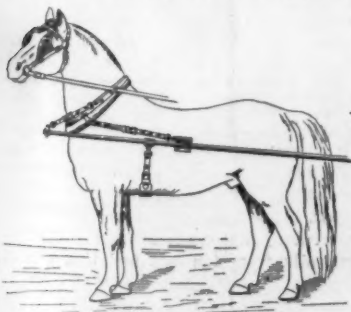
DEVICE FOR PREVENTING THE CREEPING OF RAILS.—J. T. BLUFF, Butte, Mont. The ordinary means of fastening rails to ties consists in spiking the rail to the tie. If the spikes become loosened, as they are very apt to do, the rails may sometimes move longitudinally. The object here is to provide means for preventing the creeping of the rail without sacrificing the strength of the rail.

Pertaining to Recreation.

BILLIARD-CUE.—O. D. BLOOM and J. H. HILL, Portland, Ore. This invention is an improvement in billiard cues such as are constructed of separable shaft and butt sections, whereby the cues can be packed for shipment to better advantage and the butts repeatedly used, thus saving a great amount of high-priced material and labor.

Pertaining to Vehicles.

DRAFT HARNESS.—THOMAS W. SCHLATER, 303 Second Avenue, N. Nashville, Tenn. The harness is formed of but few parts, so that the animal may be harnessed and unharnessed very quickly. It is provided with straps, which



DRAFT HARNESS.

connect the harness with the forward ends of the shafts. The tug straps are secured to spring devices mounted on the shafts, so that they will yield when starting to haul a load, thus enabling the animal to exert his energies more effectually, and prevent undue strain on the parts.

VEHICLE-BODY.—D. J. KERSTETTER, Green Ridge, Mo. The inventor provides a vehicle bed preferably of conventional box form, and a cab having a rigid frame hinged at the lower rear edge to the bed to swing rearwardly as a unit from over the bed, whereby either an open or closed conveyance may be had, the cab frame being covered with canvas or equivalent material and having suitable windows for ventilation and for passing out the mail.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.



Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of June 18th, 1910, or will be sent by mail on request.

(12293) G. B. F. asks: An invalid had the telephone laid on to my church, which enables her to hear the services distinctly. She is anxious to extend this privilege to another invalid, who is unable to hold a receiver, or bear the weight of one on her head. I am wishful to know, through your valuable paper, if any "megaphone" attachment can be procured, by which a telephone, let us say, placed on a table might be heard by persons in a room, without being obliged to hold any instrument to the ear? What a boon this would be in a hospital ward! A. We do not know any megaphone attachment for the telephone which will enable a message to be heard throughout a large room. It would seem to be easy to adjust a receiver upon a stand so that the invalid who is unable either to hold or wear it could have it adjusted to the ear and thus be able to hear the church services. A stand like the one used for an incandescent lamp bulb might serve the purpose.

(12294) W. H. R. says: Will you please advise a subscriber as to whether there is any device on the market by which a flow of water under low pressure can be made to exert a greater pressure on a smaller flow? I desire to secure some means of atomizing a stream of water about 1/16 inch in diameter, with a city pressure which is insufficient to accomplish this result by means of the usual spray nozzle. A. Water may be raised against a higher pressure either by a water ram or by a small steam pump used as a "water lift." Steam pumps are sometimes sold under this name. The Union Steam Pump Company, Battle Creek, Mich., can probably advise you with regard to such pumps. Articles on the hydraulic ram have appeared in the SCIENTIFIC AMERICAN SUPPLEMENT; but unless you specially desire to construct a ram yourself, it will be preferable to purchase one from one of the manufacturers. Water rams are advertised in the agricultural papers and hardware magazines. Possibly the best way to atomize your small stream of water would be by a compressed-air jet. Compressors such as are made for barber shops and other small uses, driven by electric motor, in connection with a turbine jet, such as made by the Turbo-Humidifier Company of Fitchburg, Mass., would perform the necessary work of tearing the water into fine drops and projecting them in a jet. There are therefore three ways—the hydraulic ram, which is not very economical; the water lift pump, which is more economical; and the compressed-air jet, which would be the most efficient of all.

(12295) T. M. H. says: A asserts that a bullet fired from a gun directly upward will strike the earth at the same speed and with the same momentum as that with which it left the muzzle of the gun. Is this correct? A. A bullet fired directly upward would strike the earth upon its return with the same speed and momentum as that with which it left the gun, if it were fired in a vacuum, where there would be no resistance to its flight, and it could maintain its theoretical speed, gravity only acting upon it. But this cannot be the case in the air. The air exerts a very considerable retarding force upon a bullet in its flight. This reduces the height to which the bullet can rise. In its fall it is simply a falling body, like a stone tossed into the air. It falls from an altitude less than it would have attained by the force of the powder alone, and so does not attain the velocity and momentum it would have attained had it risen to its theoretical altitude. A is wrong.

(12296) J. W. E. says: I have a watch with a first-class movement. It is kept on board ship. It is not worn continuously, and lies for considerable periods in one position. It has, under the influence of the ship's dynamo, become magnetized, and is consequently erratic in its timekeeping. Will you kindly explain how to demagnetize it, and, especially, if it is possible to construct a box or covering of any sort in which it can be

placed and not be disturbed by electrical or magnetical disturbances? A. A watch may be shielded from magnetism, unless exposed to very powerful fields, by wearing or keeping it in an iron case. Such cases are sold by dealers in watches, and should be found in your city. If the magnetism is very powerful, there is no certain protection for a watch. It should not be carried into a very strong magnetic field. A watch is demagnetized most perfectly by placing it in the field of an alternating current. Make an electromagnet by winding a coil of wire around a bundle of iron wires, and hold the watch at the end of this coil while an alternating current flows through the coil. In a few seconds the magnetism of the steel parts of the watch will be destroyed. Jewelers generally have the appliances for doing this, since they frequently are called upon to treat watches which have become magnetized. If you are not familiar with such apparatus, you would better take your watch to a jeweler or an electrical engineer for treatment. It can probably be treated at the power station in your city.

NEW BOOKS, ETC.

FIGHTING SHIPS. By Fred. T. Jane. London: Sampson, Low & Co., Ltd. 525 pp. Price, \$8.50.

This remarkable publication, which is now in its thirteenth year of issue, exhibits, in the 1910 edition, all the qualities which have rendered the work so popular and useful, not merely with naval men, engineers, and technical students, but with that vast body of laymen who take an intelligent interest in the growth of the world's great navies. The distinguishing feature of this edition is the large number of new illustrations which have been included, reaching five hundred in all. Naturally, much of the new material refers to the rapidly growing German navy. There are photographs of the new dreadnought and cruiser "Nassau" and "Bilcher"; and views are given of several battleships, which show the latter to have been considerably altered in appearance. Information regarding this navy is hard to get. Such as Mr. Jane publishes, however, he vouches for as thoroughly accurate. Photographs of the United States battleships reveal a complete transformation, due to installation of the lattice-work masts. A large number of the United States auxiliaries are now shown for the first time. Of no little interest are the views of the Japanese dreadnoughts "Satsuma" and "Kurena." This issue contains the usual valuable tables of guns, with full details of their ballistic power, together with shaded diagrammatic representations of the relative penetrative power of these guns. A similar shading is used on the armored portions of the warships—a method which gives an admirable offhand impression of the defensive qualities of each ship. In Part 2 are the usual special articles, one by William Hovgaard on the further development of the seagoing battleship; another by Percival A. Hislam on national expenditure and naval strength; the third by Lieut. A. Rice, R. N., on a reserve of electrical power in warships.

THE WONDERS OF PHYSICAL SCIENCE. By E. E. Fournier. London and New York: The Macmillan Company. 16mo.; 201 pp. Price, 50 cents.

According to the publishers' note, the book before us aims at "exalting the scientific spirit which leads men to devote their lives to the advancing of natural knowledge, and as showing how the human race eventually reaps the benefit of such research." Mr. Fournier's book is well calculated to serve that purpose. His wonders are largely historical wonders; for he describes the achievements in science of the great physicists in physics. His book has the merit of being strictly up-to-date, for it even includes an excellent description of the discovery of the X-rays and the achievements in aviation.

THE PRINTING ART. Volume XV. March, 1910-August, 1910. Cambridge, Mass.: University Press, 1910. Large quarto; 484 pp. Price, \$3.50.

The Printing Art in its tasteful monthly covers is always a welcome visitor. The semi-annual volumes are nothing more than the six numbers bound together with all of the advertisements and the covers, which is a very wise thing to do, as there is a vast amount of matter in the advertising pages which is of interest not only to printers, but to those who buy printing. Each volume is better than the last; it is almost impossible to call attention to the various interesting features. The samples of commercial work which have been selected for reproduction are of the highest quality, and reflect great credit upon the various designers. One of the most remarkable reproductions in the whole book is the portrait of Alphonso XIII. by Sorolla. The perfection to which the three-color art has been raised is shown by an excellent reproduction of an automobile on a road in a forest; every detail of the blue car is brought out with absolute fidelity. Typographically the book is fully equal to the preceding volumes, and shows the remarkable vitality of the ideas for which The Printing Art stands.

THE MARINE DIRECTORY FOR 1910. Boston: B. B. Crowninshield, 1910. 8vo.; 296 pp. Price, 60 cents mailed.

The Marine Directory issued by Mr. Crowninshield, who is a well-known naval architect,

also includes annual catalogues of the yachts for sale or chartered. This ephemeral feature of the book is very far from being a detriment, in fact, it is among the most interesting parts of it. The book also contains an Atlantic Coast pilot from Canada to and including New York harbor. We are pleased to note that the chart of New York harbor is up-to-date. It was our privilege to review a book along the same lines a short time ago, where even the Ambrose Channel was ignored and where the old Scotland Lightship was shown. Errors of this kind are inexcusable, and the present book is free from these blemishes. There is also miscellaneous information such as funnel marks, flags, tables of weights and measures, etc., which are of value to yachtsmen and other navigators. There are also tables of distances and bearings, high-water tables, and a summary of yacht-racing rules and seamanship. There is no one more competent than Mr. Crowninshield to supervise a compilation of this nature, which should be of service to all yachtsmen.

XXTH CENTURY SHEET METAL WORKER. A Modern Treatise on Modern Sheet Metal Work. By H. E. Osborn. Chicago: The American Artisan, 1910. 16mo.; 86 pp.

In this work the author has endeavored to give concise explanations which will be easily understood by the young apprentice and which will be at the same time sufficiently scientific for the practical use of the journeyman. The problems seem to be very well selected and very well worked out. The diagrams are all on a good scale and are clearly executed.

ROMAN CITIES OF ITALY AND DALMATIA. By Dr. A. L. Frothingham. New York: Sturgis & Walton Company, 1910. 12mo.; 343 pp. Price, \$1.75 net.

For several centuries after her foundation, Rome and the territory she controlled was only an insignificant patch in the Italian peninsula. The Etruscans and Umbrians, Latins and Volscians, Samnites and Campanians bulked larger than Rome at various times before the Punic wars. From them Rome borrowed most of the elements of art and culture. Yet they are not generally studied. Of ancient Italy most cultured persons know hardly more than Rome and Pompeii. In our imperfect knowledge of what Rome itself was during the first seven centuries, we must turn to these ancient cities, and to the numerous colonies modeled on the mother city in order to tighten her grip on each new bit of territory. Such a picture of ancient Italy and pre-Augustan Rome, drawn from her rivals and early offspring, has not yet been written. This book by Prof. Frothingham is a first sketch in popular form. After a trip through Italy and Dalmatia, where the evolution of these centuries can be studied without foreign admixture, this book brings us back to Rome with a far clearer idea of its art and culture in pre-Augustan and Augustan times.

INDEX OF INVENTIONS

For which Letters Patent of the United States were issued for the Week Ending September 20, 1910,

AND EACH BEARING THAT DATE
[See note at end of list about copies of these patents.]

Abdominal and pelvic supporter, E. F. Small	970,961
Abreaching block and carrier therefor, H. Gaudier	970,619
Abreaching wheel, R. Gardner	970,618
Abreaching wheels, tool for truing, O. H. Collier	970,962
Acid derivatives containing a phenyl group, etc., N. Sulzberger	970,662
Aerial navigation, E. P. Marable	970,942
Aeriform environments, producing pure or mixed, H. J. R. Hemming	970,623
Agricultural implement, H. H. Boucher	970,773
Air and gas mixing device, S. H. Hale	970,919
Air compressor, J. W. Gardner	970,487
Airship, W. E. Morrison	970,632
Alarm, see Burglar alarm.	
Alarms or other devices, apparatus for operating, G. I. Rockwood	970,933
Amalgamator, J. H. McNeill	970,636
Ammonia, obtaining, N. Caro	970,883
Ammonium chloride, making, Fresh & Co. sedge	970,989
Amusement apparatus, T. F. Gilbride	971,003
Amusement device, E. Morgan	970,624
Animal shelter, C. J. Best	970,873
Ant trap, C. B. Miller	970,528
Atomizer, M. von Trautmann	970,676
Autographic registers and typewriters, means for combining, E. J. Barker	970,780
Automatic time switch, H. C. Calvis	970,882
Automatically locking lock for doors and the like, A. Lehter	970,628
Automobile fender, Y. M. Crochard	970,852
Awning attachment, C. P. Sester	970,950
Baking with quick heating and cooling, E. Virgili	970,862
Band cutter, J. Karman, Jr.	970,924
Bandage, hot water, Forbes & Dart	970,667
Bed, sofa or dayport, E. M. Hulse	971,008
Beer dispensing apparatus, A. D. Jones	970,927
Belt finger, mechanical, G. J. Gollmar	970,765
Binder, loose leaf, B. S. Hubbard	971,097
Binder posts, attachment means for, H. Krumm	970,510
Blanks, machine for making shived, L. L. Hartwell	970,699
Robbin boring machine, L. C. Baldwin	970,601
Robbin holder for spinning spindles, F. Oshrit	970,743
Body forming machine, C. W. Graham	970,626
Book and pamphlet, illustrated, F. B. H. Newell	970,943
Books, fitting for loose leaf, A. T. Warner	970,582
Books, making impulse and scrap, W. G. Butler	970,692
Bottle and jar closure, F. J. O'Brien	970,558
Bottle washing machine, W. Reidel	970,718
Bottle, water, A. L. Rwing	970,767
Box, see Collapsible box.	
Box closure, H. Matchett	970,844
Box fastener, W. H. Murphy	970,620
Brake, E. A. Nelson	970,726
Bright machine, Peters & Brown	970,546

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Bucket cutting machines, milling attachment	
for, J. E. Eddell	970,554
Burglar alarm, W. H. Cook	970,468
Burglar alarm, C. H. Smith	970,565
Cabinet, kitchen, J. S. McQuinn	970,537
Cabinets, etc., flexible closure for, Jones &	
Parsons	
Steel	970,832
Calipers, W. H. Harris	970,817
Cameras, window key for, C. Bornmann	970,963
Can ladles, making, C. W. Graham	970,622
Can cap hammer, Odquist & Lyche	970,539
Can making apparatus, C. W. Graham	970,704
Can testing machine, C. W. Graham	970,621
Counting machine marking attachment, G. J.	
Laing	970,839
Car coupling, F. C. Reynolds	970,553
Car door closure, A. Faget	970,800
Car door, freight, F. L. Laine	970,587
Car door hanger, L. S. Pratt	970,752
Car fender, Frey & Lutz	970,696
Car uncoupling mechanism, O. Anderson	970,778
Cars, all protection, motor and truck, and	
support for, J. Erickson	970,900
Carburetor, J. P. Ryan	970,916
Carburetor for gas engine, L. C. Gerken	970,916
Cart, concrete, C. A. Baker	970,487
Cartridge belt, W. C. Fisher	970,906
Cash register, J. P. Cleal	970,798
Caster device for tubs, etc., leg lifting, W.	
Terrill	970,860
Casting mold pressure small and	
apparatus for, B. Platschek	970,949
Cellulose, manufacture of threads, filaments,	
strips, and films of, L. P. Wilson	970,589
Centering machine, G. B. Brown	970,979
Chain attachment, eyeglass, R. R. Mattern	970,853
Change making machine, I. Rosenfeld	970,557
Chemical compound, A. Eklund	970,898
Chisel, See finger chisel	
Chuck, planer, W. H. Henschel	970,710
Chuck, J. T. Anthony	970,676
Chuck, J. H. Hopkins	970,823
Cigar chest, A. Sargent	970,946
Cigar cutter and lighter, W. A. McAnany	970,533
Circuit controlling device, P. Dunning	970,478
Circuit controlling device, J. K. Lutz	970,523
Circuit controlling mechanism, W. A. Atwood	970,450
Cleat, C. H. Stahl	970,567
Cleaning device, Clements & Hostler	970,567
Cloth feeding machines, salvage feed for,	
J. C. Whittier	970,697
Clothes pin, Wiley & Hanger	970,867
Clothes wringer, R. B. Spencer	970,566
Crotch, M. L. Poulter	970,548
Crotch, friction, C. F. Bledsoe	970,450
Cork and the like, R. Klingner	970,834
Cork or faucet, A. C. Schuermann	970,562
Code system, cable, C. H. Keen	970,716
Coke oven, heating arrangement for, retort,	
E. W. Hagg	970,729
Collapsible box, K. Smith	970,780
Collar attachment, E. M. Crane	970,891
Column base, S. L. Riley	970,555
Combination lock, M. L. Hillebrand	970,924
Concrete mixing machine, H. J. J. Alcox	
and	970,870
Concrete structures, form for building, D.	
M. Duller	970,908
Container closure, R. H. Harbeck	970,496
Controller handle, F. E. Case	970,684
Cooker, steam, W. A. C. Murphy	970,638
Cork, laminated transformer, O. Wiener	970,587
Cornet, J. E. Doolittle	970,967
Cotton baling and product of the same,	
manufacturing, E. W. Thompson	970,971
Cotton chopper, R. Stallings	970,988
Cotton from the boll, apparatus for picking,	
C. C. Earle	970,095
Cotton gin, T. D. Fallon	970,482
Counting apparatus, thread, A. L. Chronik	970,795
Crane, J. H. N. Wiley	970,773
Crane, bridge for overhead traveling, C. L.	
Taylor	970,572
Crushing machine, J. E. Symons	970,571
Crotch attachment, K. D. Harding	970,496
Cultivator attachment, J. O'Malley	970,743
Cultivator, subsoil, O. J. Springer	970,769
Cultivator, two-row, A. C. Lindgren	970,513
Cultivator, wheeled, A. C. Lindgren	970,514
Culvert pipe, C. O. Wolf	970,772
Cup, See shaving cup	
Curtain holder, P. Heffler	970,819
Cycles, etc., saddle support for motor, C. E.	
Recker	970,458
Damper, automatic, A. W. Arnold	970,933
Desk, H. M. Leese	970,933
Desk attachment, M. Tennant	970,970
Desk pad, J. E. Goring	970,811
Die roller, adjustable, F. J. Conboy	970,888
Dish washing apparatus, A. Babcock	970,872
Display cover, C. H. Myers	970,732
Dividing apparatus, R. Hagg	970,826
Door, metal, G. Carlson	970,985
Door stop brace and fastener, combined, W.	
J. Rohan	970,602
Door suitable for closing opening in ship's	
bulkheads and other purposes, F. L.	
Leese	970,838
Drift gear, J. F. Courson	970,802
Drag, grader, and scraper, road, W. S.	
Walker	970,580
Drilling machine and drill, V. J. Wahlstrom	970,670
Dust collectors, tubular guard for, P. C.	
Miller	970,530
Dye and making same, vat, B. Bohn	970,879
Ear protector, A. Passman	970,544
Egg and cream beater, D. Taylor	970,969

THE PRODUCTION OF CONCRETE PIPES BY CENTRIFUGAL ACTION.

(Continued from page 253.)

duced into the chucks of the various machine units, of which all the chucks are tightened until they closely encompass and simultaneously center the mold. The central set of idlers is finally lowered, so that the mold is carried only by the rolling chucks, after which the machine is started, the mold being set rotating at a speed which, according to actual conditions, varies between 500 and 1,000 revolutions per minute.

The centrifugal force thus produced will throw the plastic mass in the mold toward the molding wall, pressing it tightly against the last, while distributing it uniformly, yielding to the centrifugal pressure, so as in its turn to assume the shape of a tube, which entirely incloses the metal skeleton. However, the action of this pressure will throw any water out of the plastic mass, driving it, on account of its smaller specific weight, toward the interior of the mold, where it further takes part in the centrifugal action, pressing from inside against the walls of the mold.

The process occurring in the rotating mold thus automatically produces the molding, the pressing, and at the same time the drying of the sample in a very short time. After 10 to 15 minutes the machine should be stopped, the movable set of idlers lifted, the chucks loosened, and the mold conveyed over the idlers out of the machine, which from the opposite side can immediately again be charged with a new mold destined to undergo the centrifugal action.

Special means had to be designed in order to prevent any decomposition of the mass, due to a stratification of the individual components. In the case, e. g., of a mixture of cement and sand, the water used for preparing the pulp is previously mixed with some carefully disintegrated asbestos fiber which, by becoming entangled by the cement pulp, counteracts any decomposition produced by the wandering of sand grains to the wall of the mold.

In order to produce, by the rapid rotation of a plastic mass in a centrifugal mold, cylindrical tubes of uniform thickness in an axial direction, the cylindrical mold should be located horizontally, lest the mass, owing to its gravity, drops toward the lower side, and there forms a thicker wall than on the opposite side.

If, however, conical tubes of any cross-section are to be produced, the mold should be of the same form. If, now, the axis of this mold be horizontal, the plastic mass, owing to its gravity and the centrifugal force, will be driven toward that side of the mold which has the largest diameter. Again, if the axis be located in a non-horizontal direction, the force acting on the mass will be dependent on its weight, the speed of rotation of the mold, the angle formed by the mold sleeve with the axis of the mold, and, finally, on the inclination of the axis toward the horizontal.

Of these five points, the weight of the mass and the form of the mold are generally determined by the composition of the mass and the prescribed dimensions of the sample, whereas the three remaining points can be altered at will. Now, as these three factors determine the path of the centrifugally-moved particles, they should be controlled with a view to producing the desirable arrangement of those particles. This is effected by means of the following patented process:

The axis of the inclined mold (*a* in Fig. 3) is tipped so that the under surface has a downward inclination toward the smaller end. This imparts to the plastic mass, according to its dilution, a variable tendency of dropping toward the lower side of the mold, while being driven by centrifugal force toward the opposite side. Now, with a given inclination (*a* in Fig. 3) of the axis, and a convenient speed of rotation (both of which should be determined experimentally, depending on the tapering angle of



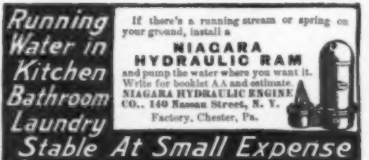
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Concrete Reinforced Concrete AND Concrete Building Blocks

Scientific American Supplement 1548 contains an article on Concrete, by Bryson Cunningham. The article clearly describes the proper composition and mixture of concrete and gives results of elaborate tests.

Scientific American Supplement 1558 gives the proportion of gravel and sand to be used in concrete.

Scientific American Supplements 1567, 1569, 1570, 1571, and 1572 contain an elaborate discussion by Lieut. Henry J. Jones of the various systems of reinforcing concrete, concrete construction, and their applications. These articles constitute a splendid text book on the subject of reinforced concrete. Nothing better has been published.

Scientific American Supplement 997 contains an article by Spencer Newberry in which practical notes on the proper preparation of concrete are given.

Scientific American Supplements 1568 and 1569 present a helpful account of the making of concrete blocks by Spencer Newberry.

Scientific American Supplement 1534 gives a critical review of the engineering value of reinforced concrete.

Scientific American Supplements 1547 and 1548 give a resume in which the various systems of reinforced concrete construction are discussed and illustrated.

Scientific American Supplement 1544 contains an article by Lewis A. Hikka, in which the merits and defects of reinforced concrete are analyzed.

Scientific American Supplement 1551 contains the principles of reinforced concrete with some practical illustrations by Walter Loring Webb.

Scientific American Supplement 1573 contains an article by Louis H. Gibson on the principles of success in concrete block manufacture, illustrated.

Scientific American Supplement 1574 discusses steel for reinforced concrete.

Scientific American Supplements 1575, 1576, and 1577 contain a paper by Philip H. Wormley, Jr., on cement mortar and concrete, their preparation and use for farm purposes. The paper exhaustively discusses the making of mortar and concrete, depositing of concrete, facing concrete, wood forms, concrete sidewalks, details of construction of reinforced concrete posts.

Each number of the Supplement costs 10 cents.

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the cone) the pressure of the mass toward the tapering side will accurately balance the pressure exerted toward the opposite side of the mold. In this case a conical tube will be produced with walls of uniform thickness.

Should, however, the intention be to increase the thickness of the walls on one side, all that is required will be to impart to the axis of the mold a greater inclination toward that side, or else an increase or reduction in the speed of rotation, according as the wide or narrow side of the mold is concerned.

It is also possible to design the outside sleeve of any cylindrical or conical tubes manufactured according to the process described, either round or polygonal as desired, to provide them with slots and laths and to adopt any decorative profile. Muffles and flanges are readily produced during the centrifugal process by fitting the front walls of the mold with convenient cores.

The concrete mass produced by the centrifugal machine shows a far more dense and uniform consistency than either cast, stamped, or compressed concrete, owing to the thorough mixture produced by rotation, and to the separation of any excess water. As the dried concrete mass inside the rotating mold continually undergoes the action of the full centrifugal pressure, which acts without any interruption uniformly on the whole periphery of the mold, the concrete mass is made to distribute and to condense itself in a most perfect manner in the centrifugal mold. The natural color of centrifugal concrete is cement-gray, no protective coating being required to insure its durability.

The process above described lends itself for the production of cable conduits, sluice conduits (especially in the case of heavy earth pressures and unfavorable local conditions), insulating tubes for electrical conductors, air pipes, pit rings, etc., in mines, pit tubes, chimneys, columns (filled, if desired, with concrete) for engineering and underground structures, pillars, railway sleepers, girders and beams for architectural buildings, as well as for timbering in the working of mines (being safe against putrefaction, fire and water, as well as insulating and sound-damping) for high-quality massive ceilings, telegraph poles, signaling lamp and conductor masts.

BY AIR LINE ACROSS THE ATLANTIC.

(Continued from page 259.)

of the tank, and thence back to the body of the tank. The car is completely inclosed in canvas.

The airship is provided with three gasoline engines, two of which are used for power purposes, while the third serves as a donkey engine. The power engines are rated at 80 to 90 horsepower, and are situated near the center of the car.

The engine shafts are disposed at right angles to the car, and each shaft drives a pair of screws through the medium of bevel gearing. Unlike other airships of this type, no stabilizing planes are provided, and there is no sliding weight by which the airship may be directed upward or downward. Instead, the propellers of the after engine are ingeniously mounted so as to be capable of angular motion in a plane parallel with the car, and thus drive it either upward or downward. This mechanism is made possible by the use of miter gears between the power shaft and the propeller shaft. The propeller shaft journal is carried by a conical support projecting laterally from the car, and this conical support is itself capable of being revolved on its axis by means of a worm gear operated by a hand wheel. As the propeller shaft is turned through an angle, the gear it carries is free to travel on the gear keyed to the power shaft. The forward propellers are 11 feet 8 inches in diameter and the after pair 10 feet 4 inches.

The donkey engine, which is rated at

10 to 12 horse-power, is used for a variety of purposes. One of the most interesting of these is the office of cranking the power engines. The donkey engine shaft is geared to the power engines by means of clutches which are automatically thrown out as soon as the power engines are started. The donkey engine also serves to drive a blower, by means of which the ballonets may be filled with air to keep the balloon inflated. The arrangement of these ballonets is shown in one of the accompanying diagrams. There are four of them forward and two aft, all fed from a common duct. Each ballonet, however, is provided with its own individual valve, so that the distribution of weight (for air in this case is ballast) can be controlled and the ship be kept on an even keel.

The rudder at the rear of the car consists of three vertical planes. The central plane is broader than the other two, which are set back a few feet so that when the rudder is turned sharply the plane at the inner side of the turn will not close against the car and cut off or screen center plane.

The airship is to carry a crew of six, namely, Mr. Walter Wellman, Mr. Melvin Vaniman, the chief engineer; Mr. Murray Simon, junior officer of the steamship "Oceanic," who will be the navigator of the expedition; Mr. J. R. Irwin, the wireless telegraph operator, and two mechanics. The sleeping quarters of the crew will probably be in a lifeboat swung beneath the car. This lifeboat, which is 27 feet long and of 6-foot beam, weighs less than a thousand pounds, being constructed of layers of mahogany veneer and canvas. It is provided with two watertight compartments fore and aft, and is a self-bailing boat.

The boat will be plentifully stocked with provisions, so that in case of accident to the airship, the crew may take it until picked up by a passing vessel. The boat is provided with a jury mast and sail. If it be necessary to cut the balloon open for a sudden descent, it may be done in the manner shown by one of our diagrams. A rope passes around the body of the balloon, and at one end carries an anchor-shaped knife. When this rope is pulled, either of the points of the anchor-shaped knife dig into the envelope, ripping it open. As soon as one seam is cut the strain will be sufficient to part the other seams as well. The boat is suspended on self-releasing hooks, so that by slashing a rope, it may be released instantly. One of the illustrations shows a section through the lifeboat, giving a general plan of the berths, etc. The wireless telegraph apparatus of the expedition will be located in the forward compartment of the lifeboat. The current for this system will be taken from a storage battery charged by a small dynamo driven by the donkey engine. This same storage battery will serve to energize an electric lighting system for the car and the boat. The radius of action of this system will be about 100 miles. In addition to this, there will be telephonic communication between the car and the boat.

In the Arctic expedition the main problem was that of food, as the expedition had to be prepared to make an overland journey in sledges in case of accident to the balloon. In the present expedition the food problem is insignificant, because it is proposed to make a short but quick passage of the Atlantic, and to effect this the balloon must be driven at high speed. The engines, therefore, have the most voracious appetite of the expedition. Each engine is capable of driving the balloon at the rate of twenty miles an hour. The combined power of the engines will be but 26 miles per hour. It will, therefore, be more economical to run one engine at a time, using the other as a reserve in case of accident; or if it should be necessary to avoid and ride out contrary winds, both engines might be used together for a short time. Taking a speed of twenty miles an hour, it

(Continued on page 266.)

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(Concluded from page 266.)

empty the bag of a certain amount of hydrogen per day, its place being taken by air pumped into the ballonets. Fortunately, hydrogen is a good fuel, and Mr. Vaniman has adapted the forward engines to burn hydrogen as well as gasoline. Because the action of hydrogen when exploded is more intense or abrupt than that of gasoline, a special hydrogen carburetor has been required for this purpose. By burning the contents of the envelope as well as that of the gasoline tanks, the radius of travel of the airship will be considerably increased. The gasoline is pumped directly to the engines from the main tank, so that there is no danger of exposing it where it is liable to be carelessly ignited or exploded.

The equilibrators pass down through the center of the car, and through a well in the center of the lifeboat. It is supported by a pair of cables running forward, and another pair running aft. To provide a certain amount of flexibility to this support sections of manila rope are introduced into the steel cables as illustrated. A pair of winches serves to pull in the upper pair of cables, taking the strain off lower pair, so that they may be disconnected from the equilibrators by a member of the crew in a boatwain's chair. The uppermost tank is then hoisted and the cables made fast below it. Thereupon the upper cables are slackened and detached to permit of drawing the tank up. It is interesting to note that when the winches are operated to pull in the cables the equilibrators are not lifted, but the airship is lowered.

The problem of navigating the airship is one that will doubtless prove quite puzzling. To be sure, the sextant and chronometer can be used in the ordinary way to determine the position of the balloon from time to time. However, since the winds are so changeable, it will be necessary to keep a practically constant watch on the motion of the airship with respect to the water. For instance, the airship might be pointed east and be traveling at the rate of twenty miles an hour through air, but if the air were in motion southward at twenty miles an hour, the actual course of the balloon would be southeast, and it would be absolutely impossible to determine its actual course by wind vanes or instruments of such character, because they would have no connection with land or sea as a basis for the direction of motion. To determine the direction of travel of the airship, then, it would be necessary to keep in touch with the water, and this will probably be done by means of a log line thrown from the lifeboat. It will not be necessary to determine the course of the vessel with any great degree of accuracy, for it will not have any particular port for its objective. The only aim is to get across the ocean and land anywhere in Europe, or even in Africa.

The time for the start will be chosen when winds are blowing from the west. Assuming that the craft sets out on a breeze of thirty miles an hour, its actual rate would be fifty miles an hour over the water, and if the wind held good the ocean would be spanned in two and one-half days. In case head winds should be encountered, the navigators propose to turn at right angles southward. It is well known that storms in the northern hemisphere have a circular counter-clockwise motion, and if the wind blows from the east it indicates that the storm center is somewhere to the south, and that at an equal distance the other side of the storm center, a wind of practically the same velocity will be found blowing from a westerly direction. Thus the navigators of the air, if they can cross to the other side of the storm center, may be assured of a favorable breeze. At this time of the year, it is found that the wind blows quite steadily from the west for long periods of time, and it is upon these favorable winds that the expedition is basing its hopes.

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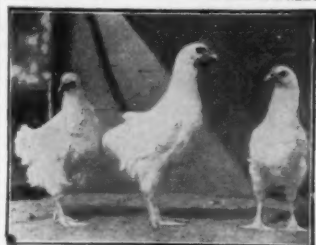
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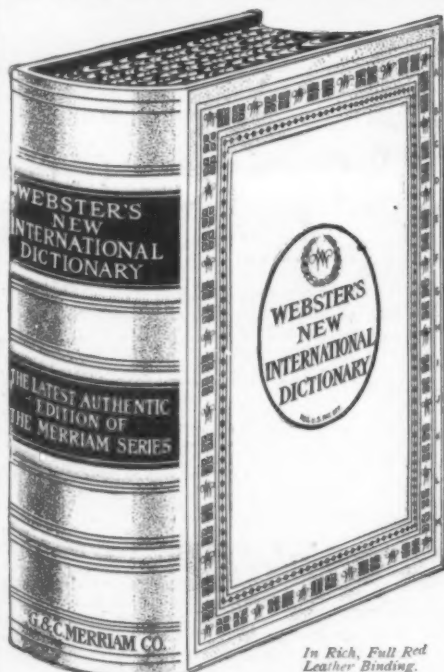
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